This magazine is published to promote sound thought upon and concerning industrial medicine and traumatic surgery. To that end it will contain articles, news items, reports, digests and other presentations, together with editors' comments. The editorial policy is to encourage frank discussion. On this basis contributions are invited.

Industrial Medicine

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Modern Medicine and Surgery

—Some of Its Great Accomplishments—

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IT MIGHT be of interest to recall something of what the past 25 years have brought to the art and science of medicine and surgery.*

Such a discussion on this occasion must of necessity be sketchy, superficial and inadequate, colored by personal prejudice, distorted by dogmatic opinion. Therefore you will pardon me, I am sure, if in the development of the general theme these weaknesses creep in and digression and animadversion be necessary in the expression of opinion and belief.

Twenty-five years, a long time—a short time! Long as measured by an individual life; short in time itself; long in prospect, short in retrospect.

Long or short, our 25 years will go down in history as a most remarkable period, a period of unrest and change, of strife and movement, of invention and scientific progress, during which things spiritual and material, economic and social, have been shaped and molded, destroyed and recreated as seldom, if ever before, in so brief a time. We have seen the earth yield her resources to the pioneer and miner, witnessed the metamorphosis of these material products by the chemist, engineer and manufacturer, seen man turn from the land to the town, industry outdo agriculture, and the machine assume the function of man in industry and supplant the beast in transportation. We have beheld with amazement the development and application of electric energy, the discovery of the internal combustion engine; and we have been contemporary with scientific triumphs innumerable.

Into these pregnant years of our remembrance has been crowded more progress in our own science of medicine than all the slow march of the preceding centuries could boast. So intensely have we lived, so great has been the change in all that pertains to human experience, that we can but inadequately understand the significance of it all. It may well be that those who come after and enjoy a more detached and less prejudiced perspective will more intelligently evaluate what has been accomplished. Time may prove that much that we now deem progress was only change.

The surgeon, trained as he is in the hard school of experience, is, or should be, fitted to judge with reasonable accuracy the life of his time, the forces which influence it, the results arrived at—for, of all men, he should "see life steadily and see it whole."

He faces life in the raw with all its lurid sidelights, its tragedies, emergencies and denouncements. He is familiar with the whole wide range of human experience, physical, intellectual, spiritual, his mind attuned to its most lofty notes, accustomed to its more sordid moods, sensitive to its motives and impulses, charitable to its every phase.

AS AN humble member of this so great cult, and with this background of professional experience ever in mind, I shall attempt to review some of the outstanding accomplishments of the period, trusting that, as the narrative carries on, you may each turn back with me the leaves of the book of memory and come along from there to here—from then till now.

When Professor William David Haggard, of Vanderbilt University, assumed the presidency of the American College of Surgeons, he presented the following apostrophe to surgery:

"The surgeon must, with fingers that are dexterous beyond compare and with mind that plans, see the completed result in his imagination. He models and commands the method, carries out the procedure, puts the parts into perfect apposition, but God knits the scar.

"He sews severed arteries that they may carry their crimson torrent without leak and without hindrance. The delicate nerve must be spliced to give the return of welcome sensation to palsied arm. He sews the viscera so truly that they become water-tight. He mends the splintered bone and repairs the lacerated flesh while holding to the skirts of the frightened spirit, lest it should flee in flight.

"When a surgical operation is described as

* Presented at the Eighteenth Annual Meeting of the Surgical Association of the Atlanta and West Point Rail Road, the Western Railway of Alabama, and the Georgia Railroad, Atlanta, March 24, 1938.

beautiful, it seems incongruous and uncanny to the layman. To one who can appreciate its beauties it is really the acme of artistic perfection. A resection of the stomach by a master like Mayo, widely excising the diseased part, restoring continuity and function, all so deftly, and beautiful in its beneficent invasion and conquest, is a magnificent epitome of the surgical art.

"Uneasy lies the head that wears a crown, but only the surgeons knows how uneasy lies the head that wields the knife. It requires such intrepidity, such clairvoyance. Cutting must be done with such consummate skill that no unnecessary or vital structure be injured. The layman thinks of an operation as purely a wielding of the knife. The surgeon actually does much more in hemostasis, in clean removal of pathological conditions, in the restoration of normal relations, in the sewing of tissues and the closure of wounds. This is itself an exquisite piece of craftsmanship, even to the tying of the last stitch."

THE first recorded surgical operation performed under artificial sleep, which today is called general anesthesia, had for its scene: the Garden of Eden; its subject: Adam; and the surgeon: The Creator of all things. According to Genesis: "The Lord God caused a deep sleep to fall upon Adam, and he slept; and He took one of his ribs, and closed up the flesh instead thereof."

From that day to the present there has gone forward a tireless search for some harmless and effective means of inducing that "deep sleep" that renders the subject unconscious of pain.

Recently a very interesting report upon cyclopropane as a new anesthetic agent has been made by Waters and Schmidt, from the University of Wisconsin. An important advantage of this gas is the low concentration necessary to produce narcosis. Occasionally this concentration may be as low as 4%. (The average concentration used for abdominal operations is 13.1%.) Because of this low concentration, it is very easy to give enough oxygen, and so the color of the patient remains good. Also, for the same reason, respiration can be very slight, which makes the work of the surgeon easier. Induction is pleasant; ringing in the ears, fullness in the head, etc., are less frequent because of the avoidance of oxygen want. This gas will produce deep anesthesia with good muscular relaxation without respiratory irritation.

SURGICAL progress is so rapid that it is almost impossible for the popular imagination to keep up with it. It is a surprise—we might even call it a shock—to read that expert surgery had now advanced to the point of amputating the "pain nerves" and therefore relieving suffering. The "pain nerves" themselves are no new discovery. It is simply another name for the sensory nerve fibre which leads to each particular part of the body. It is a surprise to most of us that the surgeon can remove this messenger of pain. Yet Professor Francis C. Grant, of the University of Pennsylvania Medical School, described just this process before a clinical congress held at Yale.

We say it is almost a shock to be told that these messenger nerves may be removed by the knife, and a condition of insensibility thereby induced—a shock because we thought it was a necessity of the body to be warned by the nerves when something in us is out of order. In other words, we thought that we needed to suffer. But Professor Grant tells us that the removal of these complaining nerves makes possible the painless surgical treatment of certain diseases and troubles, and that the nerve amputation causes no loss of control over the affected area.

PATIENTS who suffer excruciating pain from incurable cancer or chronic heart disease may find relief through the work of Dr. Loyal Davis, of Northwestern University. Dr. Davis has discovered that pain in the internal organs is carried to the brain by a different route from pain in the framework of the body. Pain in the inner organs may therefore be relieved by severing certain nerves in the affected area. One patient was relieved by clipping the nerves about his heart, apparently without impairing the action of that organ.

Certainly, with one development and another, medical and surgical science is giving the *coup de grace* to what we used to call the "ministry of pain"—that is, the idea that a certain amount of suffering is desirable for our spiritual discipline. Once we were taught that we ascended to moral heights through the endurance of pain—that pain is rendered a blessing in disguise by its power to cleanse the soul of the desire for pleasure and comfort. But if the notion that this life, with all its pains and aches, is a sort of purgatory for our moral elevation, is a good doctrine, it is losing its hold upon the present generation. We abolish pain whenever we can. We reject its purifying ministry—if it possesses such a function. Suffering has no part in the religion of science. No doubt, if we can get rid of it altogether by the amputation of the "pain nerves" without detriment to the safety of the body, we shall have them summarily removed.

Achievements of the operating room read like fairy tales. In the surgical reports of almost any large hospital you will find wonder stories of human carpentry. Splicing living nerves as an electrician splices wires, dovetailing bones as a carpenter dovetails wood, sewing muscles in place as a seamstress sews cloth, so the modern surgeon adjusts and repairs the human body.

A MIRACLE of surgery was performed three years ago upon a boy born without arms. When he was 12 years of age, an x-ray showed that each armless shoulder concealed a small, undeveloped piece of arm bone. Dr. Harry E. Mock, a Chicago surgeon, decided upon a daring experiment. He made two four-inch incisions below each shoulder and reached the hidden, shriveled bone. Carefully cutting it free, he pulled it outward to an angle of 30°. To supply muscles to move the bone, the surgeon freed one end of the powerful chest muscles. Next, he laced them to

the outer layer of the bone, using strong braided silk. Finally, he covered the stump with grafted skin and let it heal.

Day by day, the power and flexibility of the stumps increased. By the time the boy had gained full control of them, he was ready to be fitted with artificial arms. He soon learned to use these so expertly that he can now dress himself, and even write letters on an ordinary typewriter.

Repair work on arteries is one of the most ticklish tasks a surgeon has to face. Yet, in Paris not long ago, surgeons actually joined two arteries together, as a plumber might join pipes, to form one continuous channel for the blood stream. This was part of a spectacular operation upon a boy, which made a new thumb out of his great toe.

A case in which a man lost all four fingers in an accident but retained his thumb resulted in a dramatic piece of work by the famous New York surgeon, Dr. Fred Albee. Bone was cut from the patient's shinbone to create a finger. Rapidly, it was shaped on a miniature lathe, given a screw thread at one end, and then screwed into an opening drilled in the bone at the base of the missing forefinger. A flap of flesh from the patient's abdomen, was molded around the bone and sewed up. In time, the bone grew solidly to that of the hand, and the finger, although it has no joint, enables the patient to button his clothes and handle tools.

Because grafted bones must be transferred quickly and must be the same type as the rest of the patient's bones, they are usually taken from his shin. For this reason, bone surgeons often refer to the shin as the human lumberyard. In a few months after a piece has been removed, new bone forms and fills the gap.

GLAND surgery, today, is a realm of bewildering possibilities. Here and there in the present records, we catch glimpses of wonders that may lie ahead.

The thyroid gland in the neck is chief of a great system of ductless glands that pour potent chemicals called hormones into the blood and exert a powerful influence over mind and personality. An over-active thyroid acts like an open damper in a furnace, burning up body energy faster than it can be replaced. An under-active thyroid slows down the mind. It has been calculated that three and a half grains of the thyroid chemical, throxin, is all that stands between intelligence and imbecility!

In one dramatic instance reported from Cincinnati, a young man suffering from an over-active thyroid became alarmingly nervous. His weight dropped rapidly, his eyes bulged, and every muscle in his body constantly quivered. In a few months, he had become a raving maniac, kept in a strait-jacket.

In his operating room, Dr. Joseph L. DeCourcy removed most of the patient's thyroid, leaving just enough to keep the body functioning at normal speed. The young man's mental derangement disappeared completely, and a few months later he was able to resume his normal work.

Up to a few years ago, operations upon the thyroid gland were accompanied by considerable loss of blood because this organ is richly supplied with arteries and veins. Recently, however, surgeons have been using the "radio knife," an electrified needle that sears the blood vessels as it severs them, and thus prevents hemorrhage.

Operations are also performed upon the tiny parathyroid glands, minute organs no larger than buckshot. Usually four in number, two on either side of the windpipe, they are so effectively hidden by the thyroid that nobody noticed their existence until 1880. In some mysterious way, they control the amount of lime in our bones. When these glands become too active, our bones become soft; when they are not active enough, the bones became brittle.

A few years ago, a sailor was brought to the Massachusetts General Hospital, in Boston, suffering from a puzzling malady. In eight years he had grown seven inches shorter! He had suffered seven fractures from inconsequential falls, and had become so weak that he had been obliged to give up his work.

An x-ray examination showed that the patient's bones had lost their lime in many places. His parathyroid glands were over-active. Dr. Edward P. Richardson removed two of the four organs and the trouble disappeared. The man was able to return to his work, and later x-rays revealed that the bones had gained a healthy lime deposit.

ONE of the greatest medical discoveries of all time in connection with glands is the application of insulin to the treating of diabetes. Insulin is a product of the pancreas, a large gland lying behind the stomach. It acts upon the sugar contained in the blood, enabling the body to burn it and convert it into energy. When the pancreas fails to secrete sufficient insulin, sugar accumulates in the blood and diabetes results. More than a million sufferers in the United States alone are being aided by insulin obtained from the fresh pancreas glands of animals.

In Chicago not long ago, Dr. George DeTakats performed a dramatic operation which may lead to conquering diabetes by surgery. Making an incision in the abdominal wall of a diabetic patient, he pushed the stomach aside and reached the pancreas. Around a portion of this organ, he tied tightly a strip of living membrane taken from the patient's thigh. This constricting loop caused a part of the gland which secretes gastric juices to waste away. Correspondingly, the portion which manufactures the hormone insulin, grew more active. In this way, the pancreas was stimulated to manufacture its own insulin and reduce the seriousness of the disease. Similar operations have since been performed with encouraging results.

Researchers are probing deeper into the mysteries of glands. Yet, in spite of the wonders already accomplished, surgeons know they are just beginning. No other branch of medicine offers more important or more dramatic possibilities for the future.

THE past 25 years have brought about great improvement in the internal relationships of our profession. The old antagonisms and acerbites have for the most part given way to a spirit of tolerance and cooperation. This happy change is largely the result of medical organization and improvement in transportation and communication. Justice and charity are always engendered by personal contact. It is hard to be unkind to those with whom we constantly associate. We have learned to know with Emerson:

"Life is too short to waste, in critic carp or cynic bark,
Quarrel or reprimand; 'twill soon be dark;
Up! Mind thine own aim and God speed the mark!"

Ours is an honorable and satisfying calling, the most worthwhile job known to man. Our time has been a part of that period of which Sir William Osler said: "In little more than a century, the medical profession has done more for the race than has ever before been accomplished by any other body of men."

To have worked at such a job, however humbly, to have lived at such a time, however inadequately, has been a high privilege, a mighty inspiration, a blessed experience. To look forward to what such a time implies is quite beyond our power, but this we know: the unfinished job awaits those who follow. Its challenge will be accepted.

The future, like the past, will be served by those competent to meet its needs!

Surgical Management of Head Injuries

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TWENTY-FIVE years ago when I began the practice of medicine practically every case of head injury was considered a surgical case.* If a definite injury to the brain or skull was suspected the injured was rushed to the operating room, given an anesthetic, and operated on. In most instances there was a blind objective in each operation. It was considered necessary to operate even though no one seemed to know or to care what the operation was to accomplish. As a result of this needless and hasty procedure a great many head cases died, not as a result of their injuries but as a result of an added injury, the operation.

This seems to have been the order of things for a long time. The alarming and needless high mortality following surgically treated brain injuries continued, and apparently medical men did not care to do anything about it. About this time, a small group of well trained and experienced surgeons detached themselves from general surgical practice and began to devote their efforts to neural surgery. In collaboration with physiologists these surgeons began to study and to apply the principles of intracranial physiology to treatment. Better understanding of intercranial hydrodynamics has taught us to abandon the early operation and to apply the simple procedure of dehydration.

Certain types of skull injuries cause such trauma that they cannot be treated by conservative measures. Some injuries cause such marked and rapid increase in intracranial pressure that their only hope is in decompression. Falling in this group are:

1. All depressed fractures, and all compound fractures whether depressed or not.
2. All extradural hemorrhages and some acute subdural hemorrhages.
3. All fractures involving frontal nasal accessory sinuses with cerebrospinal rhinorrhea or pneumocephalus.

I FEEL that it is good judgment to elevate all depressed fractures of consequence even though there be no apparent pressure. On several occasions I have gotten into trouble by not doing this.

A recent case shows what may happen in not removing all apparent harmless depression. A boy, nine years of age, was struck by an automobile. He came into the hospital unconscious but in very good condition otherwise. After two hours consciousness returned, and in six hours he appeared normal mentally and neurologically. For three days there was an uneventful march toward recovery with usual treatment of dehydration and hypertonic fluids. X-ray showed a depression near the right frontal parietal suture about four centimeters in diameter. It appeared to be a complete fracture with a depression of about one centimeter.

On the afternoon of the third day the lad showed a definite restlessness, with slowing of pulse and slight increase in blood pressure. Later in the evening there was muscular twitching in the right side of the face, and a definite muscular weakness with diminution of deep reflexes on the left side of the body. In addition there was a marked conjugate deviation with dilatation of the right pupil. Spinal pressure at this time was 30 mm. with previous reading not exceeding 12 mm. The lad was lethargic and progressively so, coming out of it only when nauseated. An immediate exploration removed the pressure and showed an edematous and lacerated brain. The dura was very tense, and when opened there was a large escape of bloody cerebrospinal fluid. A large opening was left in the skull; the dura was left open with drainage.

In this case we had a badly torn brain in addition to a depressed fracture. In spite of continued dehydration the lad had a secondary edema that he could not carry with his depressed fracture. Of course, we used poor judgment in not operating early. This was a surgical case to begin with, as are all cases in which there is a depression of any consequence. We would, however, have gotten by had the brain not been badly injured.

* PRESIDENT'S ADDRESS, Eighteenth Annual Meeting of the Surgical Association of the Atlanta and West Point Rail Road, the Western Railway of Alabama, and the Georgia Railroad, Atlanta, March 24, 1938.

EXTRADURAL hemorrhage requires prompt diagnosis and treatment. There is usually an injury in the temporal or lower frontal region followed by few immediate symptoms. The injured complains of some headache and within a few hours nausea develops. There begins the usual picture of brain compression, progressive lethargy, and contralateral semiparesis. There is usually an inequality of pupils, the pupil on the injured side being dilated. There is later a definite inequality of deep reflexes and a positive Babinski contralateral to the hemorrhage. A subtemporal decompression on the injured side should be done, the clot removed, and the bleeding vessel ligated with suture or silver clip. The middle meningeal artery is most commonly injured because of its anatomical location.

Subdural hemorrhages usually result from large cortical vessels and venous sinuses being injured. They occur for the most part in massive brain injuries in which there is a rapid medullary decompensation. Most of these cases are so serious that surgery is of no avail. They pass rapidly into coma and usually an early and merciful death. If small subdural hemorrhages are encountered in exploring an injury they should be ligated with clips, and in silent areas with electro-coagulation.

All fractures involving the frontal sinus should have early operative interference. The anterior inferior wall of the sinus is opened with a chisel or drill. The incision should be through the eyebrow beginning at the root of the nose. If a cerebrospinal rhinorrhea is present the inner wall is removed to expose the dura. A torn dura should be repaired if possible. Drainage should be established by means of a small rubber tube through the nasal cavity. When air is forced through fractures of the frontal sinus under pressure into the intracranial cavity there is always a possibility of meningitis. Early operation is indicated in pneumocephalus. and the technic is essentially the same as described in frontal sinus rhinorrhea.

SOME brain injuries are confusing diagnostically, but in the main careful study and observation will give you a fairly accurate picture of the situation. We should never lose sight of the fact that brain injuries do not travel alone; especially is this true in automobile and train wrecks. I plead guilty to operating on a compound fracture of the skull in which the patient had a ruptured bladder which was not known at the time of head operation. Fortunately, the patient recovered from both, but two trips to the operating room should not have been necessary. Please remember that no injury requires more careful and constant watching than does a brain injury. An apparent minor injury can within an hour or two hours become a serious major injury, and you should be so watchful as to know when the change occurs.

Increasing intracranial compression usually begins with nausea, pupillary changes, increased restlessness, slowing of pulse, and rise in blood pressure. This is followed by contralateral neurological changes, with semi-consciousness and coma. Most important of all in my opinion is determination of spinal pressure. It is our practice to determine, as early as is practical, spinal pressure. Frequent readings are done, and as long as the pressure is within the normal limits we have nothing to fear. Any rise whether gradual or rapid above 20 mm. in conjunction with a clinical and neurological picture demands surgery.

It is useless to operate on a massively injured brain with a medullary decompensation. It is equally useless to operate on a brain that can be treated with epsom salts, common salt and sugar. There should be no rush to the operating room with any head case. All brain injuries should spend their first few hours in bed where they are carefully watched with no unnecessary handling. Finally, every man who operates on a brain should be so equipped as to training, armamentarium, and experience that he will not add an additional injury to an already injured brain.

Tumor-Like Images in Silicosis

M. Conrozier and J. Magnin,
(*J. de Radiol. et D'Electrol.*, 21, 10:433,443,
October, 1937)

Translation by
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THIS paper is illustrated with nine large halftones of chest roentgenograms, representative of some 30 cases assembled by the authors from 1929 to date from among French rock miners in the Gard Basin.

The "snow storm" form of nodular silicosis is well known. But the authors nave been interested particularly in the nature of certain "tumoral images" in the lungs and their relation to tuberculosis.

The Radiological Characteristics of Certain Tumoral Shadows.

These appear as massive, dense, cleanly-cut blocks in the pulmonary fields—always bilateral but often affecting one lung more than the other, usually the right lung. They are more or less symmetrical and occupy ordinarily the mid-portions, while the balance of the parenchyma shows more or less reticulated fibrosis. These massive shadows are ordinarily freely detached from both the hilum and the periphery—a significant item in diagnosis. They are customarily framed on all sides by transparent parenchyma. They resemble sarcomatous metastases, being round or oval. They appear to be distinctive and peculiar to silicosis and they call to mind clearly and uniquely the idea of tumors (Figure 1).[1]

1. Figure 1: B...., 52 years old, six to eight years on the rock, followed from 1930 to 1935. This picture was made in 1932, but the case was followed by the fluoroscope for three years more.

In some cases they are sub-axillary, with vertical disposition, and recall pachypleuritis or calcified pleura. The nodular character of the masses may be rare, or absent, or again the parenchyma is riddled with small nodular shadows like miliary tuberculosis.

The tumors suggest three categories: (1) Sarcoma and (2) Sub-axillary pachpleuritis (avoiding the bases and diaphragm). These two categories comprise 60% of the cases and their above description clearly dissociates them from tuberculosis, despite theories to the contrary so long held in France and, in particular, by Doubrow and Rist. The latter, who has recently seen the radiograms, writes that they are very peculiar and cannot be confused with commonplace types of chronic tuberculosis. (3) Tumors associated with miliary shadows—where the diagnosis is difficult from a single film. Here there is clinical verification.

WHAT OF THE PATIENTS WHO HAVE THESE TUMORAL SHADOWS?

A striking feature is that the subjects are usually vigorous and muscular without evident defects and without tubercule bacilli in the sputum. A single sign however is common—dyspnea, which may be intense even in repose, resembling an asthmatic-in-extremity. This continual tugging for breath, absence of auscultatory signs and the presence of the massive shadows in the radiogram constitute the "silicotic triad". There is no other affection of the respiratory tract which resembles this ensemble.

WHAT IS THE NATURE OF THESE TUMORAL SHADOWS SEEN IN THE X-RAY PICTURES?

The specific lesion of the pneumoconioses is called nodular silicosis. This nodule, with its central fibrous mass, often acellular, and its girdle of cells, in which predominate cells impregnated with particles of silica, has been well known since described by Lereboullet and the splendid work of M. Policard. The whole point of controversy is its interpretation, and we refuse, in the light of clinical data, to consider these lesions as healed tuberculosis, and insist that massive silicosis is not as well known as the nodular type.

In the third stage, where the tumors are enclosed by miliary nodules, it should not be doubted that they are composed of agglutinated nodules. M. de Leobardy has followed patients by x-ray pictures and noted the coalescence of the nodules into tumor masses, and we have noted the same.

However, this does not hold for all cases, since it does not explain the mechanism of formation of these dense blocks whose walls are sharply demarcated from the neighboring tissues, nor does there appear to be any analogy between these tumors and confluent bacillar infiltrations. Cases followed for eight years cause us to believe that the "block silicotic" type develops by itself, after the manner of a proliferation of fibrotic tissue which retains and fixes silica, since there is a rarity and even absence of nodular shadows in the tumoral masses formed. Even to agglutinate nodules (in the nodular form), the same process evidently obtains. It is quite certain, in fact, that the pathogenesis of these tumoral forms is distinct from that of a possible miliary confluent infiltration, yet MM. Rist and Doubrow, following the authority of Irvine, consider that the process is an infectious type of pneumonia.

Admitting that certain miliary nodules are caused to cluster by ordinary infectious dusts, one cannot admit such a process, whether acute or not, as the explanation of these massive and frankly tumoral shadows. To one who has followed the evolution of these silicotic tumors, they exactly resemble benign tumors. Born in place, they grow in place.

A case is pictured of the right lung (Figures 5 and 6)[2] of a man 53 years of age, with eight years' exposure on the rock, who has shown the same tumor (in the left upper) for eight years (1929-1937) and who, in the last year, added two kilos (four pounds) to his weight and in spite of intense dyspnea, and who is in a good state of general health, but during this time an increase in size and density has occurred in the tumor, with a polishing off of its walls without the addition of nodular satellites. Could such be an infectious pneumopathy! Instead, one gets the impression of a foreign body.

It is fitting to recall the explanation of Hayhurst and of Sweaney: Very fine dense dusts reach the alveoli, block the lymphatics (lymphostasis), and prevent the elimination of the silica. When the elimination is blocked in a rather extensive pulmonary area, a silicotic tumor is formed. This tempting explanation makes the dusts the unique cause of these fibrous masses. From this it may be said there are two anatomical forms of silicosis: The nodular, which is the most common, and the tumoral, which is frequent in the Gard Basin. The two forms have nothing in common except their origin—silica dust. They have a distinct anatomic individuality: The nodular forms evolve by multiplication of miliary lesions scattered throughout

2. Figure 5: "D...., 53 years old, eight years on the rock between 1916 and 1925. Picture made in 1930." (TRANSLATOR'S COMMENT: This picture is of the left chest (upper two-thirds). A solid, quite definitely defined mass is shown in the outer and mid-zones, from the first rib to the third interspace, apparently separated from the costal margin and denser in its outer portion. There is a broad area of homogenous infiltration, likewise, above the mass and some feathering out of the lower and inner aspects of the mass with a few thin fibrous bands extending to the upper pericardium. There is no definite nodulation either in the mass or the surrounding tissues, also no cavitation. Some emphysema appears in the supraclavicular space and in the lower portion of the lung.)

Figure 6: "Same patient. Picture made in 1937." (TRANSLATOR'S COMMENT: In this, the mass has increased in size, principally from above downward, as well as in density, and is located in the mid-zone with some extension of the homogenous infiltration above it, and some broad dense bands connecting it to the costal margin. There is also indication (in the midst of quite extensive emphysema below the mass) of the above-described fibrous streaks from the mass to the pericardium, likewise, apparent direct connection between the lower part of the mass and the hilum. In all other relations, however, the mass shows clean-cut, sharp edges. There is no increase in the apical emphysema, no definite indication of nodulation either in the mass or the surrounding parenchyma and no evidence of cavitation.)

the parenchyma while the tumoral forms (without visible nodules) are made up of masses of fibrosis impregnated with silica which continue to enlarge in situ. They are, similar to the miliary seed-plots, specific lesion of silicosis. (This hypothesis is illustrated in the pictures shown.)

How Do These Patients and Their Lesions Progress?

Thirty of these patients have been seen since 1929. Certain ones of them, followed during this eight-year period, are still living and in a good state of nutrition. (Figures 5 and 6 are referred to.) But survival among them is indeed noteworthy. We find, in our observations, four patients who worked in the rock between 1898 and 1916, who show notable tumoral images, and who are still living. This means there are living patients who were subjected to the rock dust more than 20 years ago. Their x-ray pictures are shown (Figures 7 and 8)[3].

May there not, then, be cases where these silicotic masses have been tolerated for more than 20 years? Not having any x-ray reports prior to this last eight years, we cannot be certain of this. But from what we know of our tumoral shadows, which have shown scarcely any increase during this period of eight years, we think we are safe in assuming that the future will assure a prolonged survival in some of these patients. One patient, for example, ceased the rock work in 1912, at 39 years of age, because of dyspnea. He is still living and remarkably well 25 years later, at 64 years of age. It seems certain, therefore, that these silicotic masses may behave exactly like foreign bodies in the lungs.

One cannot over-emphasize, we believe, the fact that no pulmonary affection, outside of silicosis, presents a similar observation among patients whose lungs harbor tumors of such magnitude that they maintain a dyspnea of mechanical obstruction and still are at ease up to the point of effort.

But, is this long tolerance the rule? Most certainly not. We have lost this winter, in the space of several days, two patients whom we showed last June to MM. Rist and Policard. Both died within a few days of an acute exacerbation complicated with mediastinal emphysema.

About half of our patients with these tumoral shadows have died during these eight years of our observations. Most of them did not have time to become consumptive, and to our knowledge, all died with progressive asphyxia with final heart failure (the heart holds out for a long time among our silicotics).

We were able to see this winter, in his home, 10 days before his death, one of the two patients who died, and to make a fluoroscopic examination of him. We did not find any obvious modification of his radiographic picture: The portions of the lungs which had remained transparent to that time, stayed so. No superadded bacillary infiltration was discernible.

One patient, D, (Figures 5 and 6) was able to escape the last year up to an acute asphyxial finale which had necessitated the use of oxygen several days. Sputum collected during a copious hemoptysic episode was negative both by direct examination and by guinea-pig injection. He had grown stout and his pictures for a year back had undergone no modification.

Others have attempted, as well as we ourselves, to ascertain what are the fundamentally important elements in silicosis—those elements which might permit one to forsee the future of the patient.

Does Not the Quality of the Dust Influence the Evolution of the Disease?

In our opinion the dust has a double influence, one upon the evolution of the disease and one upon the modality of the lesion. Concerning the evolution it appears from the experience on the Rand, in the Transvaal, that very dense dust, with a quartz or silica content (exceeding 90%) produces a severe silicosis. As with the grinders of Sheffield, these cases die before the fiftieth year of age. This Gard stone is very hard. It contains 81.7% silica, and it is because of this factor that we have, at random, been able to isolate 30 cases of silicotic tumors. Many others have also been brought to our attention. However, the Gard Basin does not have a monopoly on these forms. We are assured that they exist in other basins. A recent statistical report published in the Belgium *Revue du Travail* of last year confirms our doctrine of an autonomous silicotic malady.

As to the modality, whether tumoral or nodular, and whatever the nature of the dust exposure, other elements than the content of silica seem to play a factor. These tumor forms are found much more frequently among (rock) miners. The conditions of labor underground in galleries where the dust is held, and the air is insufficiently renewed, and where the blasting gases stagnate for periods, explain, we believe, the differences in the action of the dust upon the lungs. This opinion is also supported by M. Belot and seems confirmed by the facts.

Does the Duration of Exposure of the Patient to the Dusts Modify the Form of the Evolution of the Lesions?

Yes, in a certain sense. It is frequently necessary for six to 10 years of labor to have been performed to create the silicotic condition. But it is a question of total effects. There are two ex-

3. Figure 7. "R...., 60 years old, three years on the rock from 1907 to 1910, and one year from 1912 to 1913, dyspneic, good general conditions." (Translator's comment: This picture shows a large, oval, clean-cut mass in the center of the right lung and a less definite, trilobed one in the mid-outer left lung with apparent surrounding nodulation in both lungs and some emphysema.)

Figure 8: "C...., 64 years old, 10 years on the rock between 1900 and 1912. Became breathless and ceased that work in 1912. Continued to work in the pit up to 1930. Very good general condition. Dyspneic." (Translator's comment: This picture shows a good-sized, clean-cut, oval mass in the center of the right lung with a great deal of both homogenous and nodular infiltration below it, with strands to the diaphragm, and the upper lobe mostly emphysematous; also a more axillary, less defined, but larger mass in the upper left, with patchy and streaked infiltration from the first to the sixth ribs, and emphysema in the extreme apex and just above the diaphragm.)

tremes. Figure 9[4] shows a man who was not exposed more than 18 months, who was employed at rock drilling between 1928 and 1930. His condition has been called tuberculosis, but he has the aspect of perfect health, has not grown thin during these last years and has had at least 15 investigations of his sputum by guinea pig inoculations, all negative. The case is one of massive silicosis with rapid extension. He has dyspnea with drawing-in and flapping of the nasal ali but it has not yet marred his general state of health.

At the other extremes of time occur those with moderate degree of dust exposure, extending to as long as 12 years. Finally, we know of two miners who, after 10 years (the one is at his seventeenth year of stonework), have lungs which are practically intact. They are mentioned in order to cite all the facts. They represent, however, only two rock drillers out of more than 70 who are unaffected after 10 years, which testifies to the gravity of silicosis in our Basin.

More important than the time of exposure to the dust is the susceptibility factor. It is not a question of general constitutional robustness. Several of the cases cited are very vigorous subjects but these stalwart, jolly fellows often carry the most beautiful tumor images, the rapidity of whose evolution has not been stayed. We agree with the observations of a majority of others that good nasal ventilation is an important individual coefficient in defense of superior respiratory protection.

Is It Possible From These Tumoral Shadows to Clear Up with Finality the Fundamentals Regarding Pneumoconiosis?

Certainly there can be no doubt in the minds of those who have seen and followed these patients, of the occupational nature of the pneumoconiosis. The official Belgium conclusion is that the prolonged inhalation of silica dust creates a specific industrial disease.

What do we see in the Gard Basin? There are at least 20 coal miners to one rock miner. We have seen a single coal miner who showed one of the tumoral shadows which we have shown here, although his case was doubtful. He had been involved with war gas and pensioned to 100%. All the other cases have occurred in rock miners.

If one considers the record of 30 of these miners with massive silicosis, the hypothesis of 30 coincidences affecting uniquely a very limited number of specialized workers is untenable. However, some will say that we must remember silico-tuberculosis, and that tuberculosis is capable of building up these blocks of fibrosis as it builds up tuberculosis nodules. To this we reply—our rock-workers become silicotic in the proportion of nine out of 10 after eight years of work. Can it be stated that only tuberculous individuals are employed for this work? In a region where tuberculosis is rare and, for a work where they employ only particularly vigorous subjects, such an hypothesis is obviously absurd.

For 18 months we have demanded that our opponents weigh our answers to these statistical arguments. No response has come.

To return to the rock miners showing the tumoral shadows, particularly those of the pure forms, and try to group the characteristics we see:

1. The radiographic pictures resemble tumors enclosed in the parenchyma. They do not recall at all the pictures of tuberculosis.

2. Clinically, the subjects who present themselves are robust, apyretic, and without auscultatory findings. The heart is usually intact. They present only one fixed symptom—dyspnea.

3. The sputa very seldom show the bacillus of Koch (we have encountered only three cases) and we observe that we have examined patients in very advanced stages where a terminal tuberculerization is without etiologic value.

4. The massive silicotic pictures are never met with outside of the group of workers breathing hard dust — dusts of silicotic rocks in the mines. The occupational origin of the silicosis cannot be doubted in the case of these tumoral forms.

Special clinical aspects, original radiographic pictures, negative laboratory examinations, absolute occupational origin: These proclaim a definite individual disease. We do not hestitate to call it pure silicosis. It is called this everywhere else. It is difficult to understand why one can, for a long period, still call the affliction otherwise in our country.

4. Figure 9: "N...., 39 years old, 1½ years on the rock between 1928 and 1930. Dyspnea since 1930, worse since 1934. Good general state of health. Now intensely dyspneic." (Translator's comment: A triangular shaped mass, with base at the periphery and apex near the hilum, occupies the midportion of the right lung, with surrounding infiltration having small annular shadows (lobular emphysema?) and several fibrous bands extending to the diaphragm which is humped at the dome. Gross emphysema appears to occupy the inner portion of the upper lobe and parts of the lower lobe above the diaphragm. The left lung shows a similar-shaped, but somewhat smaller and less dense mass in the same relative location, but with less extensive surrounding infiltration and more extensive emphysema in the upper and lower lobes.)

Chicago Tumor Institute

The Chicago Tumor Institute, recently organized as a corporation not for profit, was opened on March 21, 1938. The Institute will offer consultation service to physicians in the diagnosis and treatment of cancer and radiation facilities for cancer patients. It also proposes to conduct research and to offer training to physicians who may wish to qualify as specialists in the study and treatment of cancer.

The Board of Trustees of the Institute has Ludvig Hektoen as President, Arthur H. Compton as Vice-President, and Roy C. Osgood as Treasurer. The other trustees are Modie J. Spiegel, Mrs. Francis Neilson, Mrs. Arthur Meeker, Alfred Busiel, and Max Cutler.

The Scientific Committee is as follows: Max Cutler, M.D., Director; Sir G. Lenthal Cheatle, F.R.C.S.; Henri Coutard, M.D.; Arthur H. Compton, Ph. D.; and Ludvig Hektoen, M.D.

Headquarters are at 21 West Elm Street, Chicago.

An Interesting Kidney Case

—*Traumatic Rupture, or Treacherous Malignancy?*—

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TRAUMA is of primary importance to the railway surgeon, and while there is no structure in the human body immune to trauma, it would appear that the kidneys, by nature of their location, are less susceptible to the results of trauma than are other structures.* Although, the kidneys are well protected by the great muscles of the back and loin, and partially by the bony thorax, they are subject to contusion and rupture because of the lack of fixation of the eleventh and twelfth ribs. These injuries may result from crushing violence or blows delivered anteriorly, posteriorly or laterally over the kidney region. Because of its lowered and more exposed position, the right kidney is more often the subject of trauma than the left. It is with injury to the right kidney that this paper deals.

On the night of November 4, 1937, an engineer, aged 54, was admitted to a local hospital for treatment of injuries sustained in a fall from the steps of an engine cab. In falling, the engineer struck his right loin on an oil can. The engine was not in motion at the time of the accident. Although he immediately experienced much pain in the right loin, which he attributed to a fractured rib, he was able to bring his train into Atlanta, a distance of about 30 miles.

On admission, examination revealed an abrasion over the right loin, and a slight bulging of the same area. There was marked tenderness over the entire right flank and loin, also along the course of the right ureter. The muscles in the region of the right kidney were quite spastic. Pulse 92, temperature 98.6, and blood pressure S/189, D/94. A flat plate of the thorax showed no fractured ribs, but there was an area of density, approximately twice the size of a normal kidney shadow, in the right kidney region. The two-glass test of voided urine revealed macroscopic quantities of blood in both specimens. Microscopic examination of the urine, of course, showed innumerable red blood cells. A tentative diagnosis of traumatic rupture of the right kidney was made. As there was nothing about the patient's condition to suggest severe hemorrhage with its resulting shock, and due to the fact that most traumatic extravasations of blood have a natural tendency to cease and, later, to be absorbed, it was deemed advisable to institute expectant treatment.

The patient was put to bed and immobilized between sand bags. Morphine was given, whenever necessary, for relief of pain and to insure rest. Urinary antiseptics were given to lessen the chances of an ascending infection. Thromboplastin was given subcutaneously, in 10 cc. doses at regular intervals, in an effort to curb the bleeding, and a close watch of the blood pressure, pulse, temperature and hemoglobin was established. All urine was examined macroscopically. Under such expectant treatment, favorable cases of traumatic rupture of the kidney usually continue to pass fresh, bright red blood for two or three days, after which it becomes darker in color and finally disappears. Early operation was not contemplated in this case because the pulse, hemoglobin and blood pressure remained within reasonable limits, and the bright red blood soon gave way to darker blood which indicated that active bleeding had ceased.

After two weeks in bed, bulging in the right flank and loin had disappeared and the urine became darker brown in color. Blood in the urine was now present only in microscopic quantities, but the patient continued to complain of pain in the right kidney region. After an additional 10 days of expectant treatment, the urine had cleared to light brown in color, but microscopic examination still revealed many red blood cells, and the patient continued to complain of pain.

At this time, because of the continued pain, a cystoscopic examination was thought advisable, but this was flatly refused by the patient; so, after intravenous urography, the patient was dismissed from the hospital with instructions to remain in bed for a week and then return for additional treatment. Owing to poor illimination of the dye, no information was gained from the urograms, except that the right kidney was enlarged and the pelvis markedly dilated. The patient returned after a week and the two-glass test of the urine revealed small quantities of bright red blood. A cystoscopic examination was again advised, but was refused. The following week the patient returned and requested cystoscopic examination. At this time he was still passing small quantities of bright red blood.

Cystoscopic examination revealed no pathology in the bladder or ureters, but retrograde pyelograms showed a filling defect of the right kidney pelvis with slight dilatation of the calyces. The left kidney pelvis was also slightly dilated. The findings were suggestive of a tumor of the right kidney pelvis, and in all probability the tumor is malignant in nature.

Removal of the right kidney was suggested, but was refused, and at the present time the patient is still passing macroscopic quantities of bright red blood and is still suffering from pain in the right kidney region.

I am of the opinion that the history, together with the physical findings present immediately after injury, though strongly suggestive of traumatic rupture of the kidney, would have, if interpreted correctly, served as a danger signal of a treacherous malignancy that was slowly and without warning destroying the kidney.

* Presented at the Eighteenth Annual Meeting of the Surgical Association of the Atlanta and West Point Rail Road, the Western Railway of Alabama, and the Georgia Railroad, Atlanta, March 24, 1938.

The Basophilic Aggregation Test

—As an Early Diagnostic Factor in Lead Absorption and Incipient Lead Poisoning—*

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THE need for early evidence of lead absorption and incipient lead poisoning in an attempt to obviate the disability accompanying frank lead poisoning has prompted many inquiries seeking simple procedures that readily may be applied to large numbers of workers engaged in lead using occupations.

There are valid reasons to believe that a series of quantitative determinations of lead present in urine and feces may afford the most precise information in this situation. However, the laborious quantitative determination of lead in such excreta is far from practical when the number of workers repeatedly to be examined at short intervals is represented by several hundreds or thousands.

This situation has directed this search more particularly to the field of blood changes, since it is well established that the hemopoietic system early is affected by relatively low quantities of lead taken into the body. Chiefly, inquiries have been directed to the diagnostic significance of hematoporphyrin; the presence of pre-formed stippled erythrocytes; deviations from the usual corpuscular fragility; and more recently, the diagnostic import of basophilic-containing red cells other than pre-formed stippled cells. In this instance, the term "reticulocyte" is avoided since these cells, as such, probably do not exist in the blood stream, and their geometric patterns as seen in microscopic preparations represent semi-artifacts derived from a precursor type of cell, best observed as polychromasia. While no one laboratory test or clinical procedure promises infallibility in the recognition of early lead injury, tests based upon the quantitative determination of basophilic-containing cells provide valuable information, at least on a preliminary screening basis.

Whenever lead enters the body in amounts other than traces, one of the first (if not the first) indications of its presence may be found in the appearance of large numbers of immature red cells in the peripheral circulation.

These young red cells may be distinguished from their elders through a number of peculiar characteristics, chief among which is the presence of basophilic substance—a chemical of unknown constituency. This basophilic substance in comparatively few of these immature cells acquires within the peripheral circulation a geometric pattern characterized as "punctate stippling." The greater number do not undergo this change to punctate stippling and instead remain in the peripheral circulation for the time being with a basophilic material content highly dispersed, either in solution or in ultra-microscopic particulate size. As a result of the action of various stains, these cells become somewhat visible, as polychromasia, or polychromatophilia. It is believable that these cells with only a minor content of basophilic material, may escape detection, so that it is somewhat impractical to attempt to make counts of the total number of basophilic-containing cells in terms of those cells that present visible evidence of polychromasia.

Through artificial procedure, it is possible to bring about clumping of the basophilic material into intracellular reticular forms, so that it becomes a ready laboratory step to enumerate the totality of all cells containing basophilic material, including all those cells that otherwise might be made to appear as polychromasia, punctate stippling, etc. In general hematologic work, this artificially created cell appearance has come to be accepted as a "reticulocyte," but in connection with lead work, these formations early were designated as "Basophilic Aggregations," and the test procedure commonly applied when lead absorption or poisoning is suspected has come to be designated as the "Basophilic Aggregation Test."

In 1924, MCCORD[1] first described this diagnostic test for pre-clinical and early clinical plumbism.

Later, MCCORD,[2] in 1933, in presenting the accumulated experience with this test, stated: "A need long has existed for a simple laboratory test serving as an index of lead absorption and the eminence of lead poisoning. The basis of this test is the enumeration of the totality of erythrocytes containing basophilic substance rather than qualitative or quantitative examinations for stippled cells or polychromatophilic cells."

Again MCCORD[3] states: "Recognition that polychromatophilia, punctate stippling and reticulation are but different aspects of the same material should prompt the placement of greater diagnostic dependence upon examinations for the totality of erythrocytes containing basophilic material."

From an appraisal of many publications dealing with various hematologic tests in lead absorption and lead poisoning, it appears that scant reliance is now placed upon the qualitative determination of punctate stippling; that the making of quantitative counts of pre-formed stippled cells is comparatively little utilized because of the onerous necessity for examining large numbers of microscopic fields; that the quantitative determination of polychromasia is little attempted because of the lack of ready distinguishing features demarcating these cells from other erythrocytes. With respect to these methods, blood work in lead poisoning, apart from frank lead poisoning, has fallen into disrepute. On the other hand, the method sponsored by MCCORD and his associates appears to furnish an easy method for the ready examination of large numbers of leaded

* 1151 Taylor Avenue, Detroit, Michigan.

suspects with results of high fidelity in detecting those persons absorbing lead in quantities sufficient to produce physiologic responses. For these reasons, this test was applied in a recent outbreak of lead poisoning, which, in turn has lead to the present report appraising the merits of this laboratory test.

The Present Study

IN ADDITION to seeking to test the merits of the methods described by McCORD, this particular work has sought to correlate this test with the quantitative punctate stippled cell counts in 390 workers in the body finishing department of an automobile plant where a lead exposure was proved to exist and where lead poisoning reached epidemic proportions.

The sources of lead contamination to which these workers were exposed through inhalation were metal finishing operations, consisting chiefly of welding, torch soldering, hand filing, and power tool grinding of leaded surfaces.

An analysis of the solder in use in these operations indicated a mixture of 70% lead and 30% tin. This alloy was melted in open solder pots, gas heated, and without thermostatic control. Thermometric tests were made which revealed that a temperature of between 800 and 1000° F. was maintained at all times.

There were a total of 22 solder pots continually in use. That there was a definite contamination of the air by lead fumes was revealed by the high concentrations that were found in air samples taken adjacent to the pots.

TABLE I
AIR ANALYSIS FOR LEAD

LOCATIONS OF SAMPLE COLLECTIONS	CONCENTRATIONS (milligrams of lead per 10 cubic meters of air)
SOLDERERS	
Near first soldering operation, 3 feet from lead pot	63.5
Breathing level of solderers at first soldering operation	20.6
Soldering operation at beginning of line	13.8
Ten feet from first soldering operation, line No. 2	34.5
One foot from fuming lead pot near center of line	55.4
Soldering operation near middle of line	69.7
Three feet from lead pot near center of line	32.0
Soldering operation, center of line No. 1	17.5
Same location as preceding sample	3.6
SOLDERERS AND TINNERS	
First soldering operation, 10 feet from lead pot	55.2
First soldering operation, 2 feet from pot	50.0
First soldering operation, 4 feet from pot	59.5
METAL FINISHERS	
Ten feet from first grinding operation	8.5
Three feet from grinding operation near center of line	24.0
Grinding center of line No. 2	133.0
Sample taken over noon-hour	5.7
Sample taken over noon-hour	13.7
First grinding operation, line No. 2	47.5
Five feet from first grinding operation, line No. 2	152.0
SOLDERERS AND METAL FINISHERS	
Adjacent to lead pot between lines No. 3 and No. 4 near first torch soldering operation	91.0
Adjacent to torch soldering operation between lines No. 3 and No. 4	15.5
Breathing level of grinder, center of line No. 1	103.0
One foot from lead pot and grinding within six feet near center of line No. 2	17.0
Ten feet from lead pot and grinding within five feet near center of line No. 2	19.0
ASSEMBLERS	
Straightening bodies at middle of line; no grinding within 20 feet	24.2
Same location as preceding sample	85.0
Grinding within 15 feet and no lead pots within 40 feet between lines No. 2 and No. 3	9.6
Same general location as preceding sample	25.0
Twelve feet from lead pot and 10 feet from the grinding between lines No. 2 and No. 3	15.0
No pot within 30 feet; grinding within 15 feet at beginning of lines No. 2 and No. 3	19.0
Same general location as preceding sample	7.5
Sample taken during noon-hour, one foot from lead pot	5.3
Sample taken during noon-hour, 11 feet from lead pot	11.0
DOOR HANGERS	
Ten feet from grinding between lines No. 1 and No. 2, near the center	56.2
Three to 5 feet from the grinding at same location as preceding sample	26.0
Five feet from the grinding, near center of line	66.8
Straightening bodies and putting on doors near center of line No. 2	40.8
Adjacent to door fitters, line No. 4; fine dust dispersed into air during operation	123.0
INSPECTORS	
No grinding or soldering; filing within 20 feet at the end of No. 2 line	8.4
Soldering operation 15 feet from grinding at the end of No. 2 line	10.0
Filing operation at end of lines No. 2 and No. 3	3.8
Filing operation at end of lines No. 2 and No. 3	9.2
Beginning of line 25 feet from lead work	19.0
Beginning of line 25 feet from lead work	17.0
Beginning of line No. 2, 65 feet away from any lead work	11.0
Beginning of line No. 2, 65 feet away from any lead work	6.5
Beginning of line, 130 feet away from any lead work	10.8
Beginning of line, 130 feet away from any lead work	8.2
Ten feet from first torch soldering operation, near line No. 2	7.6
Adjacent to torch soldering operation, near line No. 2	9.0
MISCELLANEOUS	
Fifty feet from door-line between lines No. 3 and No. 4	55.0
Sixty-five feet from door-line between lines No. 3 and No. 4	43.0
Approximately the same location as preceding sample, taken immediately after work was stopped for the lunch period	13.5
Same location as preceding sample	12.7
Seventy-five feet from the end of the line between lines No. 3 and No. 4	23.0
Welding operation, 10 feet from grinding, 20 feet from lead pot, No. 3 line	47.0
Fifty feet from the end of the line between lines No. 3 and No. 4	32.0
At end of line, 15 feet from window	2.2
Twenty-five feet from corner of workroom	7.2
Adjacent to operator cleaning bodies with compressed air	54.0
In middle of bridge, near body cleaning operation	29.0

The excess solder chiefly was removed from the bodies of power grinders which threw the finely pulverized metallic dust over a maximum 25-foot radius. No provision was made to confine the grinding to any definite area, and there were no ventilating hoods. The majority of employees in the body shop were not equipped with respirators. The first operation on the conveyor line was welding, after which came the tinning, torch soldering, rough grinding, and then the finish

grinding. At the end of the assembly line the inspection was made, after which the bodies were carried on a conveyor to a spot where the accumulated dust was removed by an air blast. Here no facility was introduced to prevent the dust from returning into the workroom. The workroom accommodated seven conveyor lines with a partition extending down the approximate center of the room. Dry sweeping was done at night by a small group of men who were not equipped with respirators. Accumulated dross on the floor near the solder pots was removed with scrapers. The sweepings were reclaimed for lead, and each day approximately 2300 pounds of solder were smeltered.

Door fitting and hanging was carried out immediately after grinding of the solder. In hanging doors it was necessary to resort to pounding with hammers to fit the hinges, etc. This hammering stirred up clouds of dust that had settled on the tops and sides of the bodies during the grinding processes.

This critical account of a plant operating under unsatisfactory conditions is injected into this report foremostly to indicate the severity of exposure of workers making up this series of examinations. These conditions rapidly were bettered, so that at the time of the publication of this material there was no reason to believe other than nominal exposure persisted.

In Table I is set forth the lead analysis of 61 air samples representing the environmental conditions of the workers under consideration in this study. The Greenberg-Smith dust sampler, operating at the rate of one cubic foot of air per minute, was employed in obtaining the air samples, and the dithizone method was used in the determination of lead concentrations.

At the present time, the maximum tolerable limit for lead is usually accepted at 1.5 milligrams per 10 cubic meters of air. The latter figure represents an excess over the quantity of air breathed by the average work-

TABLE II

Occupation	Years of Service	Age	Percent Basophilic Aggregation Cells	Stippled Cells Per Million: Negative	100 to 500	500 to 1500	Over 1500
Putty Glazer	23	57	9.3				50,000
Putty Glazer	20	47	8.0				40,000
Metal Finisher	8	34	7.0				x
Metal Finisher	3 mos.	43	6.7				x
Metal Finisher	4 mos.	34	6.1				x
Metal Finisher	4 mos.	23	6.0				x
Metal Finisher	9	32	5.8				x
Metal Finisher	10	31	5.5				x
Metal Finisher	20	53	5.4				x
Metal Finisher	11	46	5.4				x
Metal Finisher	2 mos.	30	4.8				x
Assembler	4 mos.	33	4.7				x
Assembler	12	46	4.7				x
Metal Finisher	8	37	4.6				x
Metal Finisher	6 mos.	36	4.6				x
Assembler	20	42	4.4				x
Metal Finisher	3 mos.	42	4.4				x
Metal Finisher	11	31	4.2				x
Metal Finisher	9	30	4.2				x
Metal Finisher	22	44	4.2				x
Metal Finisher	4 mos.	36	4.1				x
Metal Finisher	4 mos.	36	3.9				x
Metal Finisher	8	31	3.7			x	
Metal Finisher	20	45	3.7				x
Metal Finisher	20	42	3.7				x
Putty Glazer	5	43	3.6				x
Metal Finisher	5 mos.	42	3.6				x
Metal Finisher	5 mos.	33	3.6			x	
Metal Finisher	7	26	3.6				x
Metal Finisher	13	39	3.6			x	
Metal Finisher	20	41	3.5				x
Metal Finisher	10	32	3.5				x
Metal Finisher	20	43	3.5			x	
Assembler	8	45	3.5				x
Metal Finisher	9	28	3.5				x
Putty Glazer	21	55	3.4				x
Assembler	4 mos.	27	3.4			x	
Metal Finisher	8	49	3.4			x	
Miscellaneous Work	12	41	3.4				x
Assembler	20	40	3.4				x
Metal Finisher	4 mos.	24	3.3				x
Solderer	9	27	3.3				x
Metal Finisher	21	47	3.2				x
Solderer	15	51	3.2			x	
Metal Finisher	15	45	3.2			x	
Assembler	20	41	3.2				x
Metal Finisher	3 mos.	30	3.2				x
Putty Glazer	20	42	3.2				x
Metal Finisher	25	65	3.2			x	
Metal Finisher	3 mos.	31	3.1				x
Welder	4 mos.	30	3.1				x
Metal Finisher	12	35	3.1			x	
Metal Finisher	4 mos.	40	3.1			x	
Metal Finisher	15	42	3.1				x
Metal Finisher	11	48	3.1				x
Assembler	14	42	3.0		x		
Assembler	20	58	3.0				x
Metal Finisher	15	52	3.0				x
Metal Finisher	4 mos.	41	3.0				x
Metal Finisher	4 mos.	42	3.0				x
Metal Finisher	5 mos.	35	3.0			x	
Putty Glazer	20	44	3.0			x	
Metal Finisher	15	43	2.9				x
Metal Finisher	11	32	2.9				x
Metal Finisher	13	33	2.9			x	
Solderer	2 mos.	24	2.9				x
Welder	8	40	2.9		x		
Metal Finisher	20	47	2.8			x	
Metal Finisher	4 mos.	34	2.8				x
Assembler	24	51	2.8				x
Welder	9	33	2.7			x	
Metal Finisher	1½	35	2.7			x	
Metal Finisher	20	46	2.7				x
Metal Finisher	6	46	2.6				x
Metal Finisher	4 mos.	57	2.6				x
Metal Finisher	15	38	2.6				x
Putty Glazer	24	49	2.6			x	
Metal Finisher	8	46	2.6				x
Metal Finisher	13	37	2.6			x	
Metal Finisher	6 mos.	33	2.6				x
Metal Finisher	10	33	2.6			x	
Metal Finisher	4 mos.	33	2.6			x	
Metal Finisher	8	33	2.6				x
Metal Finisher	4 mos.	40	2.6				x
Assembler	4 mos.	39	2.6				x
Metal Finisher	9	33	2.6				x
Assembler	28	58	2.5			x	
Putty Glazer	18	53	2.5			x	
Solderer	6 mos.	32	2.5		x		
Assembler	15	45	2.5			x	
Metal Finisher	15	37	2.5			x	
Metal Finisher	5 mos.	34	2.5				x
Assembler	9	29	2.5		x		
Metal Finisher	5	45	2.5			x	
Assembler	20	44	2.5				x
Assembler	20	46	2.5				x
Sweeper	14	62	2.4				x
Metal Finisher	2 mos.	27	2.4				x
Metal Finisher	2 mos.	36	2.4				x
Metal Finisher	9	30	2.4			x	
Metal Finisher	7	36	2.4		x		
Metal Finisher	15	40	2.4			x	
Metal Finisher	10	39	2.4			x	
Metal Finisher	15	45	2.4		x		
Metal Finisher	4 mos.	26	2.4				x
Metal Finisher	8	32	2.3			x	
Metal Finisher	2 mos.	27	2.3			x	
Metal Finisher	20	40	2.3				x
Solderer	10	46	2.3				x

TABLE II

Occupation	Years of Service	Age	Percent Basophilic Aggregation Cells	Stippled Cells Per Million: Negative	100 to 500	500 to 1500	Over 1500
Assembler	15	36	2.3			x	
Assembler	22	56	2.3				x
Metal Finisher	4 mos.	41	2.3		x		
Metal Finisher	12	35	2.3			x	
Metal Finisher	8	55	2.3			x	
Solderer	5 mos.	23	2.3			x	
Metal Finisher	3 mos.	23	2.3			x	
Metal Finisher	20	42	2.3				x
Assembler	20	48	2.3			x	
Metal Finisher	10	47	2.2				x
Solderer	15	46	2.2				x
Metal Finisher	15	48	2.2		x		
Metal Finisher	2 mos.	43	2.2			x	
Putty Glazer	10	35	2.2			x	
Solderer	13	34	2.2			x	
Assembler	7	32	2.2		x		
Assembler	16	44	2.2		x		
Assembler	21	49	2.2			x	
Solderer	9	41	2.2			x	
Solderer	8	31	2.2			x	
Metal Finisher	12	32	2.2			x	
Assembler	4 mos.	35	2.2			x	
Metal Finisher	7	35	2.2			x	
Assembler	9	37	2.2			x	
Metal Finisher	5	30	2.1			x	
Solderer	7	26	2.1			x	
Metal Finisher	14	47	2.1		x		
Welder	13	31	2.1		x		
Metal Finisher	3 mos.	23	2.1			x	
Assembler	7	29	2.1			x	
Welder	10	42	2.1		x		
Metal Finisher	13	43	2.1			x	
Metal Finisher	18	42	2.1			x	
Metal Finisher	20	42	2.1			x	
Metal Finisher	4 mos.	29	2.1			x	
Metal Finisher	5 mos.	22	2.1		x		
Metal Finisher	4 mos.	22	2.1			x	
Metal Finisher	8	36	2.1				x
Miscellaneous Work	20	38	2.1		x		
Solderer	5 mos.	37	2.1			x	
Trucker	3 mos.	23	2.1		x		
Inspector	2 mos.	30	2.0		x		
Welder	4 mos.	32	2.0			x	
Metal Finisher	25	67	2.0		x		
Assembler	21	43	2.0			x	
Metal Finisher	6 weeks	34	2.0		x		
Metal Finisher	3 mos.	34	2.0			x	
Metal Finisher	6 mos.	25	2.0			x	
Metal Finisher	6	36	2.0			x	
Foreman	20	47	2.0		x		
Metal Finisher	9	27	2.0			x	
Solderer	22	57	2.0	x			
Assembler	12	32	2.0		x		
Metal Finisher	18	44	2.0			x	
Metal Finisher	19	50	2.0				x
Metal Finisher	4 mos.	30	2.0			x	
Metal Finisher	8	35	2.0		x		
Metal Finisher	5	28	2.0			x	
Metal Finisher	10	33	2.0			x	
Inspector	3 mos.	40	2.0		x		
Assembler	4	37	2.0			x	
Metal Finisher	20	50	2.0			x	
Metal Finisher	4 mos.	34	2.0			x	
Miscellaneous Work	4 mos.	42	1.9		x		
Metal Finisher	13	41	1.9			x	
Metal Finisher	7	32	1.9	x			
Welder	6	34	1.9		x		
Assembler	6	50	1.9		x		
Metal Finisher	3 mos.	20	1.9	x			
Metal Finisher	15	46	1.9		x		
Metal Finisher	4	34	1.9		x		
Metal Finisher	5 mos.	28	1.9		x		
Metal Finisher	24	46	1.9			x	
Metal Finisher	3 mos.	51	1.9			x	
Metal Finisher	1 mo.	32	1.9		x		
Metal Finisher	5 mos.	22	1.9		x		
Metal Finisher	12	51	1.8		x		
Metal Finisher	15 mos.	26	1.8		x		
Metal Finisher	4 mos.	28	1.8			x	
Metal Finisher	5 mos.	31	1.8		x		
Miscellaneous Work	4 mos.	30	1.8			x	
Metal Finisher	15	37	1.8			x	
Solderer	4 mos.	24	1.8		x		
Metal Finisher	4 mos.	39	1.8			x	
Metal Finisher	18 mos.	40	1.8			x	
Solderer	8	33	1.8	x			
Assembler	7	35	1.8		x		
Metal Finisher	5 mos.	23	1.8		x		
Solderer	20	52	1.8		x		
Solderer	15	33	1.8				x
Metal Finisher	4 mos.	26	1.8		x		
Solderer	6 mos.	36	1.8		x		
Assembler	8	29	1.8		x		
Welder	10	30	1.8		x		
Solderer	8	31	1.8		x		
Assembler	9	32	1.8			x	
Metal Finisher	11	50	1.8			x	
Metal Finisher	20	46	1.8		x		
Foreman	23	42	1.8	x			
Foreman	9	42	1.7		x		
Metal Finisher	9	52	1.7		x		
Assembler	20	50	1.7		x		
Solderer	5	39	1.7		x		
Assembler	6	61	1.7		x		
Metal Finisher	20	53	1.7	x			
Assembler	20	60	1.7		x		
Welder	10 mos.	31	1.7		x		
Assembler	12	46	1.7			x	
Assembler	9	39	1.7		x		
Metal Finisher	5	29	1.7			x	

man engaged in hard work during the course of an eight-hour day. By no means will all workmen exposed to quantities of lead only slightly higher than 1.5 milligrams per 10 cubic meters of air acquire lead poisoning, regardless of the duration of the exposure. A very few may do so, but not until six or eight milligrams of lead in the specified quantity of air appears will significant numbers of workmen evince signs of clinical lead poisoning. No less, the 1.5 figure is almost universally accepted as constituting the maximum tolerable concentration.

The highest lead concentration was found at the first disc grinding of solder, and this was 152 milligrams of lead per 10 cubic meters of air. The lowest concentration found was about 60 feet from the nearest metal finishing operation, where the test was taken approximately 15 feet in front of an open window. This was 2.2 milligrams of lead per 10 cubic meters of air. Two tests were taken in the workroom about 15 minutes after work had ceased for the lunch period. These tests showed 13.5 and 12.7 milligrams of lead per 10 cubic meters of air, while tests taken in the same area, while the plant was in operation showed 55 milligrams of lead per 10 cubic meters of air.

It was estimated that each finished body required about 14 pounds of solder. The production rate at the time the tests were taken was 350 bodies per day. The personnel of the body shop consisted of approximately 400 workmen. These included welders, solderers, metal finishers, tinners, assemblers, laborers, and non-productive employees such as stockmen, foremen, clerks, etc.

Results of Blood Examinations

TABLE II records data involving the occupations of the workers, the years of service and age of the employee, and the percentage of basophilic aggregation cells, along with the stippled cell count per million red blood cells.

It may be observed that, as the basophilic aggregation count de-

creases, a similar decrease takes place in the punctate stippled cell count. With some exceptions, where the basophilic aggregation test is 3.0 or more percent, the punctate stippled cell count is above 1500 cells per million erythrocytes. When the basophilic aggregation test results are between 2.5 and 3.0%, the stippled cell counts are about equally distributed in two classifications — "500 to 1500" cells, and "over 1500" cells. In the percentile zone from 2 to 2.5, the corresponding occurrence of stippled cells is customarily below the 1500 zone, preponderantly in the 500 to 1500 zone, but with increasing instances falling into the 100 to 500 band, as the basophilic aggregation percentage decreases toward 2%. In that percentage band from 1.5 to 2%, the stippled cell counts chiefly fall in the 100 to 500 zone. Below 1.5 basophilic aggregation percentages, stippled cells rarely are encountered. Since this type of correlation has hitherto not been published so far as known, it appears desirable to present in this Table II the entire details of the observations made regarding these two types of blood examinations, with a summary in Table III.

TABLE II

Occupation	Years of Service	Age	Percent Basophilic Aggregation Cells	Stippled Cells Per Million: Negative	100 to 500	500 to 1500	Over 1500
Welder	4 mos.	30	1.7		x		
Metal Finisher	4	28	1.7				x
Assembler	4 mos.	34	1.7			x	
Solderer	4 mos.	24	1.7		x		
Welder	6 weeks	27	1.7		x		
Solderer	5 mos.	23	1.7		x		
Metal Finisher	8	30	1.7		x		
Welder	8	26	1.7		x		
Solderer	4 mos.	40	1.7		x		
Metal Finisher	2 mos.	50	1.7		x		
Assembler	9	31	1.7		x		
Metal Finisher	2 mos.	31	1.7		x		
Assembler	6 weeks	40	1.7		x		
Foreman	9	42	1.6		x		
Foreman	17	39	1.6		x		
Assembler	15	39	1.6	x			
Metal Finisher	10	43	1.6	x			
Assembler	15	70	1.6		x		
Welder	12	43	1.6			x	
Metal Finisher	20	57	1.6		x		
Metal Finisher	3 mos.	41	1.6		x		
Metal Finisher	10	52	1.6		x		
Trucker	4	27	1.6		x		
Inspector	7	45	1.6			x	
Metal Finisher	12	42	1.6		x		
Assembler	10 weeks	32	1.6		x		
Metal Finisher	8	30	1.6		x		
Assembler	12	44	1.6		x		
Metal Finisher	4 mos.	37	1.6		x		
Metal Finisher	4 mos.	30	1.6		x		
Solderer	2 mos.	43	1.6		x		
Metal Finisher	2 mos.	49	1.6		x		
Miscellaneous Work	9	54	1.5	x			
Painter	2 mos.	50	1.5		x		
Welder	5	45	1.5	x			
Welder	5	27	1.5	x			
Miscellaneous Work	19	49	1.5				x
Metal Finisher	4	25	1.5				x
Welder	4	32	1.5		x		
Solderer	12	31	1.5				x
Miscellaneous Work	5 mos.	37	1.5		x		
Solderer	10	30	1.5	x			
Painter	4 mos.	34	1.5	x			
Metal Finisher	5 mos.	26	1.5				x
Metal Finisher	4 mos.	47	1.5				x
Arc Welder	4 mos.	28	1.5		x		
Assembler	12	31	1.5		x		
Assembler	4 mos.	26	1.5		x		
Solderer	3 mos.	41	1.5		x		
Metal Finisher	4 mos.	22	1.5	x			
Welder	4 mos.	22	1.5		x		
Metal Finisher	3 mos.	28	1.5				x
Welder	3 mos.	32	1.5		x		
Metal Finisher	20	56	1.5		x		
Metal Finisher	20	40	1.4		x		
Metal Finisher	9	40	1.4	x			
Metal Finisher	10	38	1.4	x			
Sweeper	20	62	1.4	x			
Metal Finisher	18	45	1.4	x			
Solderer	4 mos.	26	1.4		x		
Solderer	10	38	1.4	x			
Painter	9	41	1.4	x			
Solderer	8	27	1.4	x			
Solderer	7	31	1.4		x		
Assembler	15	41	1.4				x
Solderer	3 mos.	29	1.4	x			
Welder	8	35	1.4		x		
Welder	4	24	1.4	x			
Metal Finisher	4 mos.	28	1.4		x		
Metal Finisher	10	37	1.4	x			
Metal Finisher	20	40	1.4	x			
Assembler	20	42	1.3	x			
Solderer	14	64	1.3	x			
Metal Finisher	9	31	1.3	x			
Assembler	10	37	1.3	x			
Painter	12	58	1.3	x			
Assembler	26	55	1.3	x			
Metal Finisher	10	36	1.3	x			
Trucker	12	30	1.3		x		
Welder	5 mos.	34	1.3	x			
Assembler	4 mos.	52	1.3	x			
Assembler	4 mos.	49	1.3	x			
Solderer	4 mos.	35	1.3		x		
Welder	4 mos.	42	1.3	x			
Metal Finisher	5 mos.	45	1.3	x			
Metal Finisher	9	33	1.3		x		
Welder	4 mos.	32	1.3	x			
Metal Finisher	4 mos.	22	1.3	x			
Welder	18	39	1.3	x			
Welder	2 mos.	36	1.3	x			
Welder	3 mos.	32	1.3	x			
Assembler	20	47	1.3	x			
Solderer	10	48	1.3	x			
Sweeper	18	61	1.2	x			
Foreman	16 mos.	38	1.2	x			
Solderer	7	32	1.2	x			
Assembler	10	28	1.2		x		
Assembler	22	55	1.2	x			
Assembler	20	49	1.2	x			
Solderer	8	24	1.2	x			
Welder	4 mos.	38	1.2	x			
Welder	12	38	1.2	x			
Solderer	3	29	1.2	x			
Metal Finisher	13	53	1.2	x			
Welder	5 mos.	22	1.2	x			
Welder	7	27	1.2	x			
Assembler	4 mos.	48	1.2	x			
Solderer	3 mos.	42	1.2	x			
Welder	9	26	1.2	x			
Welder	9	26	1.2		x		
Trucker	12	41	1.2	x			
Solderer	2 mos.	20	1.2	x			

Technique

SOME diversity in results obtained by various workers prompts the inclusion in this report of some aspects of the technique of the basophilic aggregation test.

In this study, the best features of the technique, described respectively, by McCord and his associates[4] and Jones[5] have been adopted, to which have been added certain refinements found to be useful after a four-year period of testing and experimentation involving more than 100,000 tests on both humans and laboratory animals.

Although the technique of this test is exceedingly simple, definite errors will arise unless close fidelity is extended to proper technical manipulation. Variations in technique may lead to divers forms in the appearance of basophilic substance within red cells collected from the same

TABLE II

Occupation	Years of Service	Age	Percent Basophilic Aggregation Cells	Stippled Cells Per Million: Negative	100 to 500	500 to 1500	Over 1500
Metal Finisher	9	29	1.2	x			
Solderer	2 mos.	39	1.1	x			
Solderer	4 mos.	36	1.1	x			
Welder	4 mos.	27	1.1	x			
Metal Finisher	1 mo.	25	1.1	x			
Metal Finisher	2 mos.	40	1.1	x			
Metal Finisher	20	56	1.1	x			
Metal Finisher	9	28	1.1	x			
Metal Finisher	12	48	1.1	x			
Metal Finisher	7 mos.	30	1.1	x			
Welder	23	47	1.1	x			
Metal Finisher	20	45	1.1	x			
Sweeper	5 weeks	32	1.1	x			
Foreman	8	50	1.1	x			
Sweeper	2 mos.	48	1.0	x			
Trucker	4 mos.	55	1.0	x			
Metal Finisher	3 mos.	26	1.0	x			
Solderer	9	28	1.0	x			
Welder	8	38	1.0	x			
Solderer	3 mos.	20	1.0	x			
Assembler	6 mos.	25	1.0	x			
Solderer	5 mos.	49	1.0	x			
Miscellaneous Work	21	48	1.0	x			
Welder	5	30	1.0	x			
Welder	11	29	1.0	x			
Assembler	20	59	1.0	x			
Metal Finisher	4 mos.	36	1.0	x			
Painter	3 mos.	21	1.0	x			
Assembler	9	32	1.0	x			
Welder	20	48	1.0	x			
Solderer	4 mos.	22	1.0	x			
Metal Finisher	7	48	1.0	x			
Welder	9	31	1.0	x			
Assembler	2 mos.	20	1.0	x			
Painter	9	27	1.0	x			
Clerk	2 mos.	30	0.9	x			
Welder	13	42	0.9	x			
Painter	9	28	0.9	x			
Welder	5 mos.	32	0.9	x			
Assembler	4 mos.	28	0.9	x			
Assembler	8	41	0.9	x			
Solderer	4 mos.	40	0.9	x			
Welder	5 mos.	21	0.9	x			
Welder	4 mos.	28	0.9	x			
Welder	4 mos.	31	0.9	x			
Welder	4 mos.	33	0.9	x			
Welder	4 mos.	24	0.9	x			
Metal Finisher	4 mos.	48	0.9	x			
Solderer	4 mos.	26	0.9	x			
Welder	9	31	0.8		x		
Welder	3	24	0.8	x			
Solderer	3	23	0.8	x			
Welder	4 mos.	26	0.7	x			
Assembler	4 mos.	38	0.7	x			
Welder	4 mos.	27	0.7	x			
Assembler	10	31	0.7	x			
Welder	9	36	0.7	x			
Solderer	4	44	0.6	x			

TABLE III

Percent Basophilic Aggregation Cells	Stippled Cells per Million R.B.C.: Negative	100 to 500	500 to 1500	Over 1500	Individuals	Total Workers
9.0 to 10.0				100.0%	1	
8.0 to 9.0				100.0	1	
7.0 to 8.0				100.0	1	
6.0 to 7.0				100.0	3	
5.0 to 6.0				100.0	4	
4.0 to 5.0				100.0	11	5.45%
3.9				100.0	1	
3.8					0	
3.7			33.3%	66.7	3	
3.6			40.0	60.0	5	
3.5			20.0	80.0	5	
3.4			40.0	60.0	5	
3.3				100.0	2	
3.2			42.8	57.2	7	
3.1			33.3	66.7	6	
3.0		14.3%	28.6	57.1	7	10.50%
2.9		20.0	20.0	60.0	5	
2.8			33.3	66.7	3	
2.7			66.7	33.3	3	
2.6			30.8	69.2	13	
2.5		20.0	50.0	30.0	10	
2.4		22.2	55.6	22.2	9	
2.3		7.7	61.5	30.8	13	
2.2		20.0	66.7	13.3	15	
2.1		35.1	59.0	5.9	17	
2.0	4.6%	31.8	59.0	4.6	22	28.20%
1.9	15.4%	61.6%	23.0%		13	
1.8	8.7	56.5	30.4	4.4%	23	
1.7	4.2	79.2	16.6		24	
1.6	10.5	79.0	10.5		19	
1.5	27.3	45.4	27.3		22	
1.4	64.8	29.3	5.9		17	
1.3	86.4	13.6			22	
1.2	90.0	10.0			20	
1.1	100.0				13	
1.0	100.0				21	49.70%
0.9	100.0				15	
0.8	66.7	33.3			3	
0.7	100.0				5	
0.6	100.0				1	6.15%

individual. These include fragmentation, combined reticulation and granulation, coarse and fine stippling, wreaths or bands at the periphery, balled or clumped basophilic substance near the center of the cell, edematous red cells with distended reticulum, etc. These matters are related to tonicity, acidity and time. Certain lots of stains on an empirical basis have proved unusable possibly on account of impurities. Inasmuch as immature red cells possess a quality of stickiness, they may tend to clump on the smear preparation in the course of its making. For such reasons, the details of the technique used are now presented.

Only the best quality of microscopic slides should be employed, and preferably these should be used only once. Prior to use, slides should be thoroughly washed, followed by submersion in acid and alcohol. The blood smear should be such as to obtain an even distribution with such thinness as is represented by 150 to 200 cells to the microscopic field under an oil immersion objective. These smears, after air drying, may be fixed as later discussed, and stained almost immediately, but standing up to 60 hours appears to make little difference in the counts later obtained. In one instance, smears were made on 50 individuals in duplicate. One-half were fixed and stained in six hours, while the second half were so treated at the end of 60 hours. Reading of these slides indicated a variation in the basophilic aggregation counts of 0.1%.

The fixing of one-half of the slide on a longitudinal basis affords some opportunity for error in that vapors from the methyl alcohol used for fixation purposes of one-half the slide may, in the absence of precaution, tend to fix the remaining half to some degree. Three procedures have been utilized, the first two of which are far more practical. JONES[5] devised a fixation method whereby a longitudinal half of the blood smear is covered with a strip of filter paper and is cautiously wetted with a minimum of methyl alcohol (acetone

free). This is allowed to dry until the filter paper becomes loose. The remaining half of the slide is unfixed in order that laking may take place during the process of staining. In the second method, a shallow utensil, such as a petrie dish, is filled with alcohol to such depth that one-third of the slide is submerged by dipping to the bottom of this utensil. After instantaneous dipping, the slide is allowed to dry horizontally on muslin or gauze in such fashion as not to permit any drainage onto that portion of the slide for which fixation is unwanted. In either case, a narrow band of partially fixed cells will exist at the junction of the fixed and unfixed portion of the slide, but this offers no practical problem in the performance of this test. This transition zone is ordinarily less than the width of a microscopic field. For precise purposes, it is possible to score the underside of an annealed glass slide with a good diamond, to make a smear in the usual fashion, and thereafter, prior to fixation, to break the slide into two pieces for fixation purposes. After staining, these halves may be brought into apposition for miscroscopic examination.

For staining purposes, a variety of vital stains might be utilized provided the solutions used are such that permit of cell laking. In this work, two stains have been utilized with formulae modification from time to time. Jones[5] has expressed a preference for the Sussmann-Weindel stain, about which he states:

"All factors considered, the Sussmann-Weindel solution of toluidine blue, methylene blue, and borax furnished the most unform results in examination of both fixed non-fixed films. The formula is as follows:

Toluidine blue	0.5 gm.
Borax	0.05 gm.
Methylene blue solution (Loeffler's)	5 cc.
Distilled water	100 cc.

"The borax is added to the water, which is heated to dissolve if necessary. The toluidine blue is added and allowed to stand for a few minutes; occasional stirring may hasten solution. Next is added the methylene blue. The solution is then filtered through a single No. 30 filter paper."

Our own preference is for a modified Manson methylene blue stain, prepared as follows:

Sodium borate C. P.	0.3 gm.
Methylene blue chloride	2.0 gm.
Distilled water, to	100.0 cc.

The sodium borate is added to distilled water which is brought to the boiling point. After cooling, the methylene blue chloride is added with vigorous stirring. Filtration may be desirable prior to the addition of methylene blue, and certainly is desirable after the methylene blue addition and thereafter at intervals. The life of the stain is longer if kept in a tightly-stoppered bottle. Some batches of stain yield suitable results for only about two weeks, but others for many months. The loss of desired properties of the stain is related to hydrogen-ion concentration. The addition, on an empirical basis, of a few drops of acetic acid to the stain will at times restore its wanted properties. From some preliminary and casual work, it appears that the *pH* of the properly made stain should be near 7.95 for smears that have stood up to 12 hours. If the smears have remained unstained for such periods as from 24 to 36 hours, a *pH* near 7.56 appears to be desirable. It is well established that many of the difficulties encountered by other persons in the applicaton of this method are related to improper hydrogen-ion concentration of the stain. At this time, a full quantity of pertinent facts is not available.

Actual staining with this modified Manson stain may be carried out in series of Copin jars, the time being about 10 minutes, but it is almost impossible to over- or under-stain. After staining, the slides should be rinsed in three washings of distilled water and air-dried.

Staining the unfixed portion of the slide is in effect a laking process which removes the hemoglobin, clumps the basophilic material, and brings this into greater visibility. The preliminary examination of the stained slides in making the basophilic aggregation count is done under high power to locate areas of even cell distribution. Final examination is made with the oil immersion objective without the use of a cover slip. Microscopic examination is first made in the laked portion of the smear. It is observed that the normal erythrocytes are very nearly faded from the picture. These cells appear as a faint shadow with an indistinct periphery. The white cells stain deeply and their various forms may be differentiated. The basophilic material in the red cells of this portion of the slide stands out sharply as coarse granules or as combined granules and network, or as reticulation.

The counting technique is facilitated by the use of a Whipple grid and hand counter. All cells in each field containing basophilic substance are counted. If any of these cells are divided by the outside margins of the grid, they are counted as belonging in that field. Those cells displaying basophilic aggregations in 20 consecutive fields are counted or in the case of an uneven smear, two rows of 10 consecutive fields each are enumerated. The total number of basophilic cells is recorded.

Examination is next made in the fixed portion of the slide opposite and approximating the area that was examined in the laked portion. All of the red cells within the grid are counted, including those touched by the four margins of the grid.

Five fields are examined in the fixed area. If the examination of the laked portion was made of 20 consecutive fields, then all of the red cells should be counted in every fourth field for a total of five fields. But if the cells containing basophilic material were counted in two rows of 10 fields each, then the cells should be counted in each alternate field for a total of five fields. The result should be expressed in percentage. Hence, if there were a total of 63 cells with basophilic aggregations found, this result would be: 63 divided by 4 equals 15.75, and again divided by 786,

the total number of unlaked red cells counted in five fields, equals 2.0% of the total erythrocytes as basophilic aggregation cells.

This technique is such that one sufficiently experienced technician may fix and stain 400 blood smears in one day, or may examine from 60 to 100 stained slides in a working day. In many cases, when reading slides made by the proper methods, three technicians have arrived at an agreement within 0.1% of the basophilic aggregation count. Preparations made approximately in the manner described in this section have been kept for a period of 13 years without significant deterioration.

In arriving at the approximate number of stippled cells per million red blood cells, the following technique was utilized. A blood smear slightly thicker than the smear for a basophilic aggregation count, was made, usually 200 red blood cells to the field under oil immersion objective. This was then stained with Wright's dye in the usual way. Examination was made with the oil immersion objective of 50 fields or approximately 10,000 red blood cells. The total number of stippled cells found is multiplied by 100 which indicates the approximate number per million red blood cells.

TABLE IV
General Monthly Blood Examinations

Percent Basophilic Aggregation Cells	April		May		June		July	
	Workers	% B.A.	Workers	% B.A.	Workers	% B.A.	Workers	% B.A
Negative.....	126	31.9	166	39.8	164	40.0	174	43.4
Up to 1.9 %...	104	26.3	69	16.5	84	20.4	91	22.6
2.0 to 2.9 %...	109	27.5	108	25.8	106	25.8	97	24.1
3.0 to 3.9 %...	37	9.3	41	9.8	42	10.2	30	7.4
4.0 to 4.9 %...	11	2.8	21	5.0	8	1.9	4	1.0
5.0 and up.....	9	2.2	13	3.1	7	1.7	6	1.5
TOTALS.....	390	100.0	418	100.0	411	100.0	402	100.0

At best, the examination for stippling is difficult, entailing much eye strain. Since much of the stippling is of a very fine nature, it requires close scrutiny to avoid missing these cells. The result is that the average technician can examine only 25 to 30 slides per day. Examinations of large numbers of employees exposed to lead hazards in certain industries obviously would require considerably more time than for the basophilic aggregation test.

Comment

IN THE adult human free from disease and particularly free from anemias and other dyscrasias and from bone-marrow dysfunction, the percentage of basophilic aggregations only occasionally exceeds 1.5. In the normal range, that is, usually below 1.5%, distinct variations have been reported to occur in relation to various environmental influences, such as barometric pressure, and in relation to certain glandular types. In that zone lying between 1.5 and 2.0%, there may appear the counts of a low percentage of apparently normal individuals and also in the case of lead exposure some individuals for whom there may be some evidence of lead absorption. In groups of workmen such as may be exposed to lead in any form, a high majority are free from significant disease although large numbers may present oral infection, visual defects, minor skin diseases, flat feet, and other such deviations from the usual. None of these, apart from focal infections, leads to unusual blood pictures.

In such groups of workmen who may be exposed to lead, the demonstration of basophilic aggregations higher than 2% strongly suggests but does not prove the existence of lead absorption or lead poisoning. Routine testing for such basophilic aggregation usually discloses those workmen for whom more elaborate examinations are required in order to rule out the likelihood of lead injury. Persons presenting percentages above the stated threshold customarily may be shown to present other evidences of lead intake. Conversely, those lead exposed workmen showing less than 2% of basophilic aggregation and especially those below 1.5% ordinarily do not evince very substantial findings suggesting lead absorption or lead poisoning.

Since the appearance of these basophilic aggregations is one of the earliest manifestations of the injurious effects of lead, and since their determinations in large numbers may be carried out in a short time by one person and without elaborate equipment, it appears that the routine application of this measure may serve a helpful purpose in lead-using industries.

In the present work, involving 390 persons out of a work population of 410, 32 suffered frank lead poisoning and 12 were hospitalized. Approximately 125 complained of general weakness, loss of appetite, nausea, and constipation, but lost no time because of these dysfunctions. An additional 273 individuals yielded basophilic aggregation percentages at or in exces of 1.5. The remaining 117 fell below 1.5%, and out of this group no cases of clinical lead poisoning at any time appeared. This difference in response in the presence of well established exposure for all workmen present reflects the well known fact that while no person is known to be wholly tolerant of lead, many persons are injured more readily than those about them equally exposed.

This present report is based entirely upon the results obtained from the first complete series of blood examinations of this group of workmen. In clinical instances of lead poisoning, many additional tests were made, and for the entire work force, three other complete examinations by the basophilic aggregation method and by the stippled cell technique were made at monthly intervals. The general trend was downward (see Table IV) as improved work conditions were introduced in this establishment.

After the second round of tests, an attempt was made to create a factor indicating a constant relationship between the results obtained by the basophilic aggregation and punctate stippled cell counts. Tables II and III in fact present some degree of correlation, but too great

irregularity exists to warrant any precise conversion of results from one method to the other. The accuracy of each of these two methods has been considered in relation to clinical state and other changes in cellular constituents of the blood. With respect to lead absorption and early lead poisoning, the basophilic aggregation method appears to be more accurate, although neither method in itself distinguishes between lead absorption and lead poisoning. Moreover, it is observed that insufficient criteria are available for the precise detection of pre-clinical lead states. The very method for which appraisal is sought through this investigation in itself appears to constitute the most acceptable proof of lead absorption.

Fig. I.
Typical basophilic aggregation, showing reticulation of all basophilic material. Semi-schematic drawing after Manson's staining. This is not a pre-formed punctate stippled cell

Chief exposures considered in this report are connected with metal finishing operations. However, a small number of these workers were employed in related work termed "putty glazing." Since these workers, when examined by the basophilic aggregation method, presented in some instances percentages beyond expectancy for workers unexposed to lead, analyses were made of the putty used in this operation. The analysis is now shown:

Pigment	63.70%
Oil and thinner	36.30
ANALYSIS OF PIGMENT:	
White lead	57.17%
Zinz oxide	7.67
Lamp black	3.50
Silica	5.88
Iron oxide	16.73
Barium carbonate	8.75

During the course of this investigation and afterwards, in connection with other studies made using these laboratory methods, many inquiries have been received, considerable numbers of which indicate that punctate stippling and basophilic aggregation are erroneously regarded by these persons as one and the same phenomenon. Manifestly, such is not the case, when basophilic aggregations, represent the total number of all erythrocytes containing demonstrable quantities of basophilic substances. The number of basophilic aggregations inevitably will be larger than the number of punctate stippled cells in any given unit of blood, since the basophilic aggregations represent the sum of reticulocytes, punctate cells, and all other cells that may contain basophilic substance. In a given instance, the finding of 800 stippled cells per million red cells was noted, but in the same preparation, 4%, or 40,000 basophilic aggregations were detected in this same million red cells. Because of this confusion, this paper continually emphasizes pre-formed punctate stippling as a phenomenon apart from basophilic aggregations. While reticulocyte counts yield numbers close to basophilic aggregation counts, the latter is larger in that both reticulocytes and pre-formed punctate stippled cells make up the basophilic aggregation count.

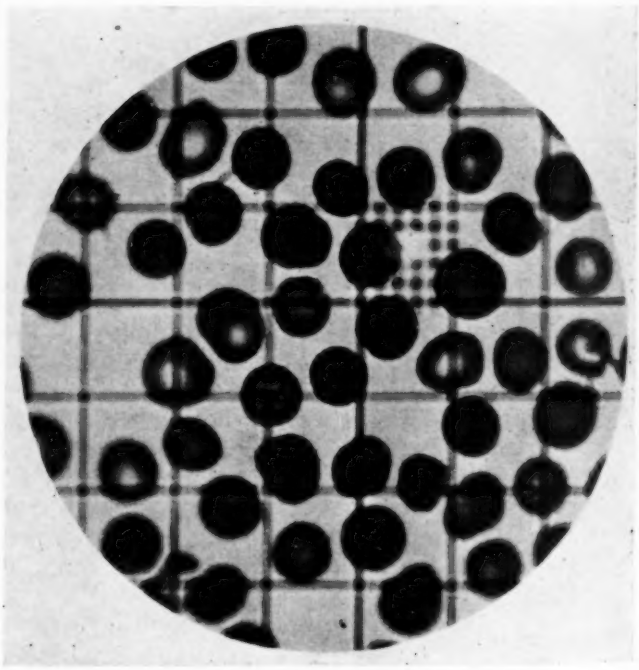

Fig. II.
Section of fixed unlaked portion of blood smear used for the determination of total erythrocyte count and cellular abnormality. Microphotograph with 10X ocular and oil immersion objective. Straight lines shown are from Whipple grid used as a guide for quantitation

This present report represents only a detached unit of observation isolated from a more general study. Therefore, it does not embrace data with reference to the influence of treatment on basophilic aggregation variations. However, general observations prompt the statement that when such chemicals as potassium iodide are used for de-leading purposes, the percentages of basophilic aggregations mount. Conversely, when calcium

medication is applied, the counts diminish, but recession to normal may not occur for many weeks or months.

Summary

THE basophilic aggregation test has been applied to 390 male workmen grossly exposed through inhalation to dusts of metallic lead and freshly produced lead oxide. The extent and location of exposure were established through 61 quantitative determinations of atmospheric lead, using the dithizone method. An attempt has been made to correlate the results of the basophilic aggregation tests with quantative stippled cell counts. The 390 workmen studied embrace a group apparently unaffected by lead, another group which absorbed lead but presented no clinical manifestations, and a third group presenting clinical lead poisoning, some of whom were so severely affected as to require hospitalization. Positive basophilic aggregation tests were established for all persons apparently absorbing lead in appreciable qualities and in all persons evincing symptoms and signs of lead poisoning. On a percentile basis, the basophilic aggregations do not stand in relation to the severity of lead poisoning in that some persons with only lead absorption presented higher basophilic aggregation counts than others suffering from frank lead poisoning. No precise correlation was established between basophilic aggregation counts and quantitative counts of pre-formed stippled cells.

Increased numbers of basophilic aggregations were not regularly encountered in long existing lead poisoning, and apparently some punctate stippled cells are more likely to persist in prolonged lead poisoning. Basophilic aggregation percentages diminished as the clinical manifestations of lead poisoning disappeared.

From the standpoint of time, economy, accuracy, uniformity and simplicity, a preference is expressed for the McCord Basophilic Aggregation Test in the examination of workers when seeking the detection of lead absorption and early lead intoxication.

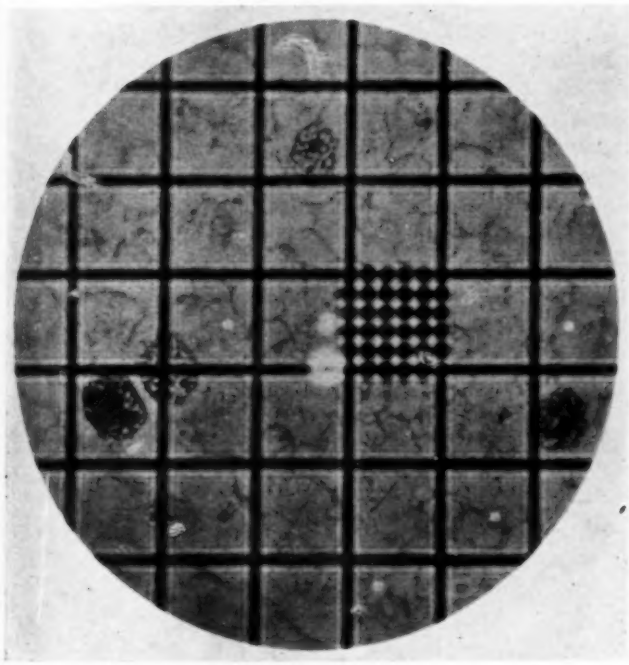

Fig. III.
Laked portion of blood smear from same slide as Fig. II, showing four typical basophilic aggregations and faint outlines of non-basophilic containing erythrocytes. Microphotograph with 10X ocular and oil immersion objective

Citations

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Minor Cuts and Lacerations

—*Importance of Thorough but Gentle Treatment*—

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MINOR cuts and lacerations make up in number of cases the greater part of the surgical work of the general practitioner, and a large percentage of them are taken care of in homes, industrial establishments, railroad stations, and at places of automobile accidents.* No doubt many of them deserve more consideration than is generally given.

The indications are: first, to stop bleeding; second, to treat shock if present; third, to prevent or limit infection; fourth, to preserve or restore function; and last, to avoid as much scarring as possible. If it is not practical to meet these indications at the time, first aid should be given and the patient carried where repair can be properly done.

All of these things we have known from our medical youth up, but the final check-up of work in minor wound repair has not been entirely satisfactory. Too many of these show infection. Occasionally, I have found at a rather late date a foreign body hidden away, and frequently more scarring than is really necessary. Cases that come for redressing from other physicians let me know that I am not the only one who makes mistakes, both of omission and commission.

A review of my own cases for the purpose of finding out the reasons for these occasional faults has taught me something and has brought about some good results. It has not been ignorance, for

* Presented at the Eighteenth Annual Meeting of the Surgical Association of the Atlantic and West Point Rail Road, the Western Railway of Alabama, and the Georgia Railroad, Atlanta, March 24, 1938.

we have all been well trained; all books on surgery go into detail as to what to do, and we are continually having papers on the subject in this association and in the surgical sections of the larger bodies. The unfavorable results have apparently been due to neglect in carying out in detail the knowledge we possess, but it is mainly caused by failure to provide suitable equipment and to keep it available at all times.

In major surgery the proper instruments, anesthesia, and the usual dressings and supplies are arranged, and the surgeon sees that they are in order before he begins work. In minor operations similar preparation and planning should be carried out, though of course on a smaller scale.

The following outfit has seemed to fill the need for me; a few needles, two or three envelopes of dermal sutures, some fine silkworm gut, a few tubes of catgut, plain and chromic, 0 and 00 (I like these better than silk as they are easier to put through the eyes of small needles), a small needle holder, scissors, two artery forceps and thumb forceps, skin slips and forceps, a Bard-Parker handle, an Asepto syringe, a LuerLock syringe and needle for anesthesia, and a pair of gloves. These are rolled in a towel and kept sterile. They make a package no larger than one's wrist and take up but little space. In the emergency bag are a rubber-capped vial of novocaine solution, some adrenalin, cotton, gauze, sponges, bandages in commercial packages, and a razor, with a bottle of salt, the ordinary table variety, a bottle of 3% iodine, green soap, and 1500 units of tetanus antitoxin. In addition I usually have a pint bottle of normal saline solution with 2 drachms of 3% iodine added to it.

The use of iodine-saline solution was begun after seeing it used extensively in the clinic of Dr. Moorhead, of the New York Post-Graduate, and has been continued because it is efficient, nonirritating, and inexpensive. The latter is quite a consideration when treating large dirty wounds or extensive lacerations and large quantities of it must be used.

A local anesthetic is another necessity for proper examination and treatment, and should always be conveniently at hand. Otherwise one is liable to take short cuts in treatment and subject the patient to prolonged care for unnecessary infection.

The usual procedure in small wounds is to flush out with iodine-saline solution.Tuck in a small piece of gauze wet with novocaine and adrenalin solution; this generally takes care of the bleeding and gives enough anesthesia for examination and painless closure. The surrounding skin is gently but thoroughly scrubbed with soap and water, and the wound is again washed out, then draped with a piece of sterile gauze or a towel and closed with sutures or skin clips, and a suitable dressing is applied. The management of larger wounds is practically the same. Anesthesia has to be obtained by injection into the parts and larger bleeding vessels ligated.

Lacerated wounds have more tissue damage. There is more or less death of structures involved, and more irregular cavities and places favoring infection; and there is frequently more dirt in them. This calls for more cleansing and thorough irrigation. Dead tissue and parts liable to die had best be cut away with a sharp knife rather than scissors.

Wounds that need drainage are probably best treated by delayed closure. Sutures may be placed but not tied. The wound is slightly packed with wet gauze and kept moist for two to four days. The sutures are then tied. In more suspicious wounds tubes may be inserted in the dressing and a modified Carell-Dakin technique carried out. I prefer iodine-saline solution or a weak solution of potassium permanganate as a wet dressing. Neither of these blisters the skin as does the chlorine solution.

Wounds about the face and exposed parts of the body deserve especial attention, careful disinfection, and accurate suturing particularly about the mouth and eyes, having a care to get proper alignment at mucocutaneous junctures.

With gentle handling of wounds, careful disinfection with mild antiseptics, a few necessary instruments and supplies, surgical technique as perfect as in a major operation, even if the scale is small, will pay large dividends. Most of us need to conserve our time and energy, and this will save us many unnecessary and harmful redressings. Thoroughness in the original treatment in hinor wounds leaves but little to do but take out the stitches and put on a final dressing.

Industrial Hygiene Course

—University of Pittsburgh School of Medicine, Department of Industrial Hygiene—

Submitted by

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THROUGH his very great interest in industrial medical problems the late Dr. R. R. Huggins, Dean of the Medical School of the University of Pittsburgh, had in mind for a great many years the desirability and the necessity of giving undergraduate instruction as well as intensified post-graduate courses concerning medicine in industry.

With an already overcrowded curriculum it seemed most difficult, nevertheless through Dr. Huggins' efforts a Chair in Industrial Hygiene was established in the School of Medicine of The University of Pittsburgh in 1936 for the practical application of medical science in industry as well as for methods of determining and eliminating health hazards from among industrial workers.

Too, its aim is that original research may be directed from this department on specific industrial health problems through part time or full time fellowships.

This course of lectures to the senior medical students is given by men who are actively engaged in the problems of dusts, fumes and gases, electricity, temperature control, fatigue, education, and medicolegal relations. The subjects are covered both from the individual and the industrial point of view. Some of the lectures are supplemented by motion pictures, slides, and exhibits.

While the time allotted to this course is short, nevertheless it is hoped it will correlate some of the work covered in other courses as they relate to industry and their practical application. Industrial hygiene is so extensive a subject it is most difficult even to consider other than the high spots in so short a period, as it is post-graduate.

Ninety percent of students will have industrial contacts at some time in their careers. Since the practice of medicine is changing not only from that of curative to preventive medicine but also from a social viewpoint, in that one hears constantly of some form of so-called state medicine, it brings to their attention a field not new but one in which much is being done and in which there is wide opportunity for great additional endeavor. It gives them a vivid understanding of industrial hygiene as that part of medical science applying to health and its preservation among the working population, and the need for establishing a most healthful environment for the workers.

Two fellowships have been established.

Industrial Hygiene Lectures

1937 - 1938

I. Industrial Hygiene . . . . . (One Hour)
- A. History
  - 1. Gradual development
  - 2. Pre-employment examinations
  - 3. Periodic examinations
- B. Employer-employee relations
- C. Community relations

II. Industrial Medical Departments . . (One Hour)
- A. Functions
  - 1. Medical
  - 2. Surgical
  - 3. Research
- B. Personnel
  - 1. Medical
  - 2. Technical
- C. Equipment
  - 1. Medical
  - 2. Engineering

III. Dusts . . . . . (Two Hours)
- A. Physical properties
- B. Determination
- C. Effects on individuals
- D. Prevention of health hazards
- E. Types of dusts
  - 1. Toxic
  - 2. Irritative
  - 3. Disease bearing
  - 4. Allergic
  - 5. Mineral

IV. Fumes, Gases, and Mists . . . (Three Hours)
- A. Physical properties
- B. Determination
- C. Effects on individuals
- D. Prevention of health hazards
- E. Types of fumes, gases, and mists
  - 1. Metallic fumes
  - 2. Alkali and acid gases
  - 3. Organic vapors
  - 4. Mists
  - 5. Normal air variations

V. Electricity . . . . . (One Hour)
- A. High and low voltages
  - 1. Skin effects
  - 2. Systemic effects
- B. Direct and alternating current
  - 1. Skin effects
  - 2. Systemic effects (circulatory, (respiratory, (internal, (P.M. findings
- C. Cause of asphyxiation
  - 1. Paralysis of respiratory center
  - 2. Paralysis of diaphragm
  - 3. Auricular fibrilliation
- D. Treatment
  - 1. Artificial respiration (history, (Sylvester, (Schaeffer, (electric pacemaker, (mechanical
  - 2. Stimulants (drugs, (heat, (counter irritants

VI. Temperature Control . . . . . (One Hour)
- A. Reactions to external heat
- B. Reactions to internal cooling
- C. Reactions to internal heat production
- D. Regulation of internal heat production
- E. Regulation of heat dissipation
  - 1. Heat prostration (sunstroke, (heat apoplexy
  - 2. Heat exhaustion (heat collapse, (heat syncope
- F. Treatment
  - 1. Therapeutic
  - 2. Prophylactic

VII. Fatigue . . . . . (One Hour)
- A. Physiological reactions
- B. Relation to accidents
- C. Relation to efficiency
- D. Preventive measures

VIII. Educational . . . . . (One Hour)
- A. Plant hygiene
  - 1. Good housekeeping
  - 2. Sewage disposal
  - 3. Water
  - 4. Lighting
  - 5. Ventilation
- B. Safety
  - 1. Mechanical safeguards
  - 2. Accident consciousness
- C. Health
  - 1. Personal hygiene
  - 2. Infectious diseases
  - 3. Chronic diseases

IX. Medicolegal . . . . . (One Hour)
- A. Compensation laws
  - 1. History
  - 2. Necessity
  - 3. Interpretation
  - 4. Variations in States
- B. Common law
  - 1. Employer responsibility
  - 2. Individual physician responsibility
- C. Insurance
  - 1. Self insurers
  - 2. State funds
  - 3. Insurance companies

X. Inspection of Industrial Plant

Industrial Hygiene

—University of Michigan—

Submitted by

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THE course in industrial hygiene, as offered in the Department of Hygiene and Public Health, University of Michigan, comprises two one-hour periods a week for one semester each year. Although listed as a graduate course, it may be elected by other students who have had special training in general hygiene.

Throughout the course it is emphasized that industrial hygiene embraces not only a hygienic program of health conservation and disease prevention among industrial workers, but also in a broader sense all the phases of general hygiene dealing not only with adults, but with all age groups, both sexes, and in its fullest meaning not only with the worker while confined within the factory, but also with the home life and domestic problems relating to health, welfare and industrial efficiency. The course is therefore concerned with measures relating to the creation and preservation of normal health; with measures relating to the detection, prevention and correction of physical and mental defects; with measures relating to the prevention, detection and treatment of illness, accidental injuries and occupational diseases; with measures relating to the scope and obligations of the first aid, safety, sanitary, personnel, medical and welfare divisions and with various measures relating directly or indirectly with the comfort, well-being and efficiency of the industrial worker and his family.

Throughout the course the dual attitudes of humanitarian service and economic returns are repeatedly emphasized. In most of the general courses in hygiene the humanitarian aspects predominate, while in industrial hygiene, the economic aspects of financial returns are always in the foreground. No doubt it would be difficult to convince the average employer as to the merits of humanitarian service for the workers, were it not for the resulting by-product of increased human efficiency and economic returns which necessarily follow.

Much stress is placed on the practical applications of hygienic procedures which the employer usually measures in terms of dollars and cents. Likewise the student is taught that the various labor laws and regulations, with special emphasis on the Workmen's Compensation laws, have been the main incentives to cause the employer to adopt the various procedures of industrial hygiene.

Considerable attention is given to the so-called human element in industry. As the mechanical machine breaks down under the stress of increased speed and worn out parts, likewise the human machine will break down under the stress of worry, fatigue, poor health, physical and mental defects. This human element in industry is of equal importance to that of a well equipped factory with its complicated machinery and automatic devices and requires a similar careful inspection, supervision and adjustment to the ever changing industrial environment.

The following outline of subject material forms a broad foundation for the study of the industrial worker and his working conditions:

Outline of Industrial Hygiene

I. INDUSTRIAL HYGIENE: Definition, scope and relation to other phases of general hygiene.

II. SOCIAL, economic and health status of workers of former times.

III. HISTORY of development of industry in Europe and the United States.

IV. PROGRESS in factory development:
- A. Crude implements used by primitive man.
- B. Domestic or household "manufacture".
- C. Handicraft systems. Pride in "finished product".
- D. Apprenticeships and guilds.
- E. Mechanical revolution brought about by the advent of iron, steel, steam, gas electricity, etc.
- F. Social and economic aspects of the industrial revolution.
- G. Contrast between primitive workshop and modern factory.

V. THREE essential phases of the industrial program:
- A. Organization:
  1. Capital, stockholders, directors, president, managers, superintendents, foremen, workers, etc.
- B. Factory equipment:
  1. Factory plant, location, construction, etc.
  2. Raw materials, availability, storage, etc.
  3. Machinery, hand machines, automatic machines, etc.
  4. Power, hand, steam, electricity, etc.
  5. Workers, accessibility, housing, etc.
- C. Plant operation:
  1. General administration, legislation, etc.
  2. Publicity, advertising, etc.
  3. Production, sales, marketing, etc.
  4. Improved methods, efficiency expert, etc.

VI. PURPOSES and motives in modern industry:
- A. Anticipation of enormous profits of first importance.
- B. Providing employment and rendering humanitarian services of secondary importance.
- C. Usual methods of production:
  1. Minimum overhead cost.
  2. Minimum time.
  3. Maximum speed.
  4. Maximum production.
  5. Production influenced by "supply and demand".
  6. Periods of prosperity and depression, non-employment, wages, strikes, etc.

VII. COMPLICATIONS arise from the growth and expansion of the factory system:
- A. Over-crowding.
- B. Illness: Colds, tuberculosis, infections, etc.
- C. Absenteeism: Cost, etc.

D. Industrial accidents.
E. Industrial sanitation.
F. Industrial ventilation.
G. Industrial illumination.
H. Occupational diseases.
I. Nuisances.
J. Industrial wastes and by-products.
K. Women and children in industry.
L. Industrial welfare.
M. Personnel problems.
N. Factory inspection, legislation, enforcement, etc.
O. Workmen's compensation.

VIII. Organization of special divisions for the control of complications:

A. General administration.
B. Sanitary division.
C. Safety division.
D. Medical division.
E. Personnel division.
F. Welfare or Service division.

IX. Necessity of cooperation of successful management:

A. Within the several divisions.
B. Among the superintendents, foremen, managers, etc.
C. Between the medical division and the general medical profession.
D. Between the plant physician and the family doctor.

X. General problems of the Sanitary Division:

A. Discussion of the common sanitary processes.
B. Location and environs of factory buildings.
C. Factory construction,—walls, floors, drainage, etc.
D. Fire escapes, stairways, elevators, blind-alleys, rubbage, etc.
E. Nuisances: Smoke, noise, etc.
F. Disposal of wastes and by-products.
G. Stream pollution: Effects upon animals and man.
H. Illumination: Natural, artificial, glare, etc.
I. Ventilation: Natural, artificial, exhaust systems, etc.
J. Drinking water: Cross connections, accessories. Toilets, lockers.
K. Restaurants: Food handlers, food infections.
L. Sanitary inspections, legislation and enforcement.

XI. General problems of the Safety Division:

A. The terms, "accidents and injuries".
B. Vital statistics on the occurrence, frequency and types.
C. Relationship of health status to frequency of accidents.
D. Importance of accidents; relationship to compensation.
E. General program of accident prevention.
F. Automatic safeguards and the human element.
G. Fire: Causes, cost, and prevention.
H. Special industrial hazards.
I. Special body equipment for accident prevention: Clothing, helmets, goggles, etc.

XII. General problems of the Medical Division:

A. Organization, scope, personnel, equipment, etc.
B. Relationship to other departments.
C. Relationship to the general medical profession.
D. Relationship: To plant physician; to family doctor.
E. Medical service in small plants.
F. Medical service in large plants.
G. First aid stations.
H. Part time and full time service.
1. First aid instructions to foremen and workers.
J. Hospitalization; operations; rehabilitation.
K. Physical examination.
L. Relationship of data to workmen's compensation.
M. Importance of follow-up examinations.
N. Objectives of good industrial medical service.

XIII. Division of Personnel Management:

A. Organization, scope, duties, etc.
B. Various criteria used in selecting new workers.
C. Importance of data from physical examinations.
D. Selection, placement and vocational guidance.

XIV. Welfare or Service Division:

A. Definition of "welfare".
B. Welfare among the early guilds.
C. Scope of activities within and outside of factory limits.
D. Source of welfare funds.
E. General welfare activities.
F. Advisory — consultations, loans, housing, banking, etc.
G. Educational — lectures, libraries, night-schools, etc.
H. Recreational—games, entertainments, contests, movies, etc.
I. Convenience—rest rooms, chairs, posture, etc.
J. Qualifications and activities of welfare nurse, etc.
K. Family welfare and home problems.

XV. Occupational Diseases:

A. Definition, nature, prevalence and importance.
B. Causes:
1. Harmful substances:
a. Infections, poisons, acids, alkalies, solvents, washes, sprays, dyes, etc.
2. Harmful working conditions:
a. Atmospheric pressure:
(1) Aviator's disease, caisson disease, etc.
b. Atmospheric pollution:
(1) Pneumokonioses, gases, fumes, etc.
c. Temperature—humidity:
(1) Heat exhaustion, frost-bites, etc.
d. Faulty light:
(1) Ophthalmia electrica, cataract, nystagmus.
e. Nuisances:
(1) Smoke, noise, etc.
3. Status of the workers:
a. Age, sex, heredity, etc.
b. Experience, ignorance, indifference.
c. General hygienic standards of workers.
d. Defects, ill health, fatigue, etc.
e. Individual susceptibility.
f. Posture.
g. Industrial neuroses:
(1) Vibrations and vaso-motor disturbances.
C. Early symptoms and signs.
D. Differential diagnosis.

E. Systems of the body affected by such diseases.
F. Preventive measures:
1. Instruction and education.
2. Legislation and enforcement.
3. Protective equipment.
G. Relationship to workmen's compensation laws.
H. Legislation in the various States and countries.
1. Special provisions dealing with hernia, heart disease, etc.
J. Silicosis and tuberculosis.
K. Lists and special considerations of various specific occupational diseases.

XVI. WORKMEN'S Compensation Laws:

A. Historical account.
B. General provisions in different laws of different States.
C. Application to occupational diseases.
D. Interpretation of phrase "out of and in the course of employment".
E. Legal technicalities of determining "whose fault is it?"
F. Humanitarian attitude of "whose misfortune is it?"
G. Various types of insurance carriers.
H. Three defenses held by employer:
1. Contributory negligence.
2. Assumption of risk.
3. Fellow-servant.
I. Application of laws in partial disability, permanent disability, death, etc.
J. Special provisions relative to hernia.
K. Provisions for "an ideal compensation law".

XVII. PROBLEMS relating to women in industry:

A. Number of women engaged in industry.
B. Woman's progress in industrial pursuits.
C. Types of work suitable for women.
D. Causes for woman labor in industry:
1. Question of equal rights with man.
2. Types of special work.
3. Demand for cheap labor.
4. Scarcity of man labor during war times.
5. Temporary jobs before marriage.
6. Necessary fund to support family.
E. Results of female labor:
1. Standpoint of employer:
a. Cheap labor.
b. Speed and reliability.
c. Good saleswoman.
d. Labor turnover.
(1) Single women and marriage.
(2) Married women and pregnancy.
2. Standpoint of women:
a. Question of ability and stamina.
b. Susceptibility to fatigue, poisons, etc.
c. Menstruation and dysmenorrhea.
d. Tuberculosis.
3. Standpoint of home life:
a. Breadwinner or home-maker.
b. Division of labor between husband and wife.
c. Home work must be done. Long hours.
d. Care and education of children.
e. Servant plan.
f. Temporary or permanent arrangement.

XVIII. PROBLEMS relating to children in industry:

A. Demand for child labor:
1. Cheap labor.
2. Special work suitable for children.
3. Ease in obtaining children for odd jobs.
4. Humanitarian attitude in providing work for "idle".
5. Ease in "firing" children.
B. Attitude of the child:
1. Dissatisfaction with school and teachers.
2. Desire for extra spending money.
3. Hopes for good position without education.
C. Greed of parents:
1. Children considered as assets on which parents may derive extra money.
2. Low ideals of parents regarding value of education.
3. Parents had set example by working.
4. Expect children to work when not in school.
D. Poverty:
1. Unfortunate conditions of home life.
2. Parents unable to support large family without extra funds.
3. Children must work to obtain necessities.
E. Indifference of parents and general public:
1. Attitude that work stimulates a habit of thrift.
2. Better to work than be idle.
3. Citation of "big" men who worked their way up.
4. Wages in city appeal to parents of rural districts.
5. Child peddlers looked upon as thrifty.
6. Failure of parents and public to realize the dangers and evil effects of child labor.
F. Results of child labor:
1. Failure to obtain an education.
2. Blind-alley positions.
3. Unwise selection and preparation for future life work.
4. Limitations in advancement in industry without education.
5. Premature breakdown of physical and mental conditions.
G. Child labor laws:
1. Present laws in the several States.
2. Present status of Federal laws.

XIX. THE PLEA for Industrial Hygiene:

A. The humanitarian attitude, as expressed by P. B. Junke, in the *Wisconsin Safety Review* for July, 1918:
". . . that the workman shall live to enjoy the fruits of his labor; that his mother shall have the comforts of his arm in her old age; that his wife shall not be an untimely widow; that his children shall have a father, and that cripples and helpless wrecks who were once strong men, shall no longer be a by-product of industry."
B. Necessity for "whole-hearted" cooperation and the development of an industrial hygiene consciousness".
C. The realization that "health is purchasable".
D. The scientific and economical approach to the problems of industrial hygiene.
E. Results from industrial hygiene:
1. Detection of disease in early stages.
2. Detection and correction of defects.
3. Prevention of illness, accidents, etc.
4. Decreased cost for compensation.
5. Proper selection and placement of workers.
6. Increased efficiency of the worker and plant as a whole.
7. Development of a "better quality of life".
8. Prevention of suffering and prolonging life.

9. Improving conditions in home and community.

XX. Miscellaneous exercises and assignments:

A. Thesis or term paper on assigned topic of special interest to the special student.
B. Visits to industrial plants for observation.
C. Demonstration of first aid procedures.
D. Demonstrations of safety equipment.
E. Laboratory methods and special determinations.
F. Special assignments for collateral reading.
G. Compilation of bibliography.

Important New Books

Toxicology

Review by

Alice Hamilton, M.D.,
Hadlyme Ferry,
Hadlyme, Connecticut

DR. McNALLY'S book on toxicology was awaited with eagerness by industrial physicians because of his reputation as a specialist with a very unusual practical experience, and although many of the poisons with which he deals are not met with in industry, the ones that are of industrial importance are given their due place. There is a full discussion of the data secured from the literature and also a wealth of first-hand material gathered from his own observations.

It is to the industrial poisons that I must confine my comments, since I am quite incapable of doing justice to the others.

Lead is, of course, one of the very few poisons whose industrial importance far overshadows any other, and the material on chronic plumbism in McNally's book is chiefly derived from industrial sources. On controversial questions in this field he speaks with authority founded on his own experience. Thus he concludes, on the basis of a study of the blood pressures of 400 workmen with chronic plumbism and of 438 without, that lead does not cause high blood pressure. He discusses the statement made by certain German and Austrian authorities, that lead may cause peptic ulcer, and says that he found it only 10 times in his 400 men, and that the question cannot be settled until large groups of lead workers and non-lead workers are compared in this respect. He is inclined to doubt a connection between plumbism and contracted kidney. He accepts the work of Aub and his colleagues, and the Fairhall test for lead or the electrolytic, holding that the colorimetric test of Kehoe and his associates is too delicate for practical use and that the method chosen should demonstrate lead as such. The best way to make a diagnosis of lead poisoning, when only one symptom may appear, is to look for lead in urine and stool and also in the air of the workroom, for if the worker absorbs from one to one and a half mg. during the day, lead poisoning may occur.

The chapter on arsenic is fascinating reading for lovers of crime stories, but relatively unimportant for us, though it contains a good description of the industrial form. McNally notes the curious fact that the latter is almost never systemic in character, but confined to the skin and mucous membranes. Arsine is, of course, far more dramatic in action. McNally has found it in the air of pickling rooms, an important statement.

As with arsenic, so with mercury, the industrial form differs from the usual. This chapter is largely devoted to the bichloride, which is of no importance to the industrialists. Phosphorus and the cyanides are other poisons whose slow action in industrial exposure brings about a clinical picture different from that of other forms of poisoning.

The chapter on fluorine and the fluorides contains interesting new material on this increasingly important element and its compounds. New matter is summarized also in the sections on manganese, cadmium, and zinc.

The chapter on carbon monoxide is very complete—this is in a way McNally's specialty—and it deals with several controversial points. With regard to the length of time that carbon monoxide is retained by the blood, he reports two cases dying after two days, and one after four days, in all of which CO was detected in the blood. In 100 of his own cases it was detected more than four hours after removal to pure air. The diagnosis never can be made with certainty without a blood test, the symptoms resemble those of alcoholism too closely. He found glycosuria (of asphyxia) in 20% of the cases admitted to the Cook County Hospital. Chronic carbon monoxide poisoning he accepts as a clinical entity for which there is good evidence, although the blood cannot be depended on for diagnosis as in acute. There is a very full discussion of the pathology and of the multiform sequelae of carbon monoxide gassing.

The sections on the halogenated hydrocarbons are of great interest to the industrial physician. McNally played an important part in tracing to methyl chloride fumes that strange epidemic in Chicago which, he tells us, involved some 98 victims.

He deals fully with carbon tetrachloride and trichlorethylene, and, in conection with the latter, gives us an unpublished case reported to him by Reese, of Johns Hopkins, in which the damage done by "tri" was confined to the eye. There was an increasing loss of vision, to the point of complete incapacitation, so that the patient was obliged to go to a home for the blind.

These are only some of the high lights of a book which deserves a more extensive review.

Toxicology, by Wm. D. McNally, M.D., was published late in 1937, by Industrial Medicine, has 1,000 pages, with tables, illustrations, and over 2,000 annotations, and is priced at $10.00.

Toxicology

Review by

W. F. von Oettingen

TOXICOLOGY, by William D. McNally (Cloth. Pp. 1022. Industrial Medicine, Chicago, 1937, Price $10), "represents an attempt to cover the entire field of toxicology, i.e., clinical toxicology, case reports, symptomatology, pathology and the treatment of poisonings.* Readers interested in the detection and determination of poisons will find ample information on such methods, which, in many instances, is given in full detail. Some poisons, such as carbon monoxide, hydrogen sulfide, fluorine, lead and arsenic are discussed very extensively; others, which are especially important from the industrial point of view, such as carbon disulfide, are covered in less detail. In places, the case reports are very detailed, but it seems that it would have been of help to the student of this subject if these had been commented on more critically. The pathology is given somewhat summarily, the treatment is frequently rather short, and one cannot always agree with the suggested therapeutic procedures. In addition, sometimes these are not very uniform, as, for instance, in Table III, where the intravenous injection of methylene blue is advocated for the treatment of cyanide poisonings, whereas in the text it is correctly stated that the administration of nitrites and thio compounds is superior to that of methylene blue. Some statements, such as that in benzene poisoning in humans the outstanding symptom is the destruction of red blood cells as contrasted with the leucopenic action observed in animals, probably will not find general agreement. In addition, it appears that no difference is made in discussing the toxicity of benzene (benzol) and benzine, two materials of different chemical and toxicological properties.

"The arrangement of the poisons according to inorganic poisoning; metals and non-metals; gaseous poisons; alkaloidal poisons (among which sulphanilamide is listed); volatiles, distillates and solvents; drugs and miscellaneous (where one finds benzene-benzine); food poisoning and food-borne infections; death from powdered glass, appears to be not very well arranged, and unless one consults the fairly complete subject index, one has difficulty in finding a certain subject. But in spite of these shortcomings, this book covers, in 1005 pages, a considerable amount of work and the critical reader will find ample information on certain topics."

Physicians' Vitamin Reference Book

Review by

C. O. Sappington, M.D., Dr. P.H.

IT IS refreshing in these days of so many books and papers to find such a small volume with so much concentrated information on the subject of vitamins.

A statement in the first part of the book is significant: "The objective of this book is to indicate concisely and conservatively the current clinical status of the recognized vitamins. Where the subject matter is controversial, both sides of the question are usually presented. This book differs from many publications on vitamins in one important respect, namely that there has been no attempt to 'stretch' the findings of studies on laboratory animals to apply to humans unless clinical reports appear to verify such application."

Vitamin A, Vitamin B Complex, B_1, Vitamin G Complex, Riboflavin (Vitamin B_2), Vitamin C, Vitamin D and Vitamin E are all considered. Under each of these headings, a summary is first given, including synonyms, chief deficiency symptoms and signs, diagnostic methods, average daily requirements, sources and foods, sources and pharmaceutical products, uses, other reported uses, chemical formula, stability, precursor, and unit of potency; then are given human requirements and good sources; manifestations of avitaminosis; other reported clinical uses; diagnosis of deficiency; treatment of deficiency; chemistry; and standardization.

Multiple vitamin deficiencies, other vitamin-like factors, and various types of products are also given space and discussion.

The little volume of 126 pages represents a concise compendium of information relative to various vitamin problems. Copies may be obtained from E. R. Squibb & Sons, New York City.

Occupational Disease Symposium

Review by

C. O. Sappington, M.D., Dr. P.H.

THE above title represents the proceedings of the First Occupational Disease Symposium held by the Northwestern University Medical School, at Chicago, September 27 and 28, 1937.

This symposium follows upon the work which has been done at Northwestern University Medical School in the establishment of a department of occupational disease in 1936, "organized to make complete clinical and laboratory studies of patients presenting occupational disease problems. There is an outpatient clinic which is a part of the University dispensaries. Endowed beds are available for those patients requiring hospital study. Clinical investigations are supplemented and correlated with a survey of actual working conditions."

The program contained the following subjects and speakers: "The Role of Allergy in Industry," Dr. Samuel M. Feinberg; "The Role of Allergy in Industrial Dermatoses," by Dr. Marion B. Sulzberger; "The Healthy Chest and the Modifying Influences of Silicosis and Silicosis with Infection," by Dr. Eugene P. Pendergrass; "Some Phases of the Pathology of Silicosis," by Dr. L. U. Gardner; "Industrial Solvent Exposures and Their Control," by Mr. Warren A. Cook; "Some Recent

* In *J. Indust. Hyg. & Toxicol.*, 20:3, (March) 1938.

Developments in the Field of Industrial Solvents," by Dr. Alice Hamilton; "Industrial Lead Poisoning," by Dr. Robert A. Kehoe.

At the banquet session on the evening of the second day, introductory remarks were given by Dr. Irving S. Cutter, Dean, Northwestern University Medical School; Mr. B. C. Heacock of the Caterpillar Tractor Company spoke on "The Prevention of Occupational Disease," and Dr. Morris Fishbein, Editor of *Journal of the American Medical Association,* on the subject "The Future of Industrial Medicine."

The discussion at the end of each paper is included in the report of the proceedings of the symposium, which greatly adds to the interest of the record.

It is regretted that it was apparently found impracticable to reproduce some of the excellent tabulations and graphs which were given by some of the speakers. Such data would have greatly improved the value of the text of the proceedings.

On the other hand, Northwestern University Medical School is the first university group to have inaugurated a symposium on occupational diseases, at least in the midwestern area.

The monograph contains 86 pages, is published by the Northwestern University Medical School, and is priced at $1.50.

Third Symposium on Silicosis

Review by

C. O. Sappington, M.D., Dr. P.H.

THIS official transcript of the Third Silicosis Symposium held at Saranac Lake, New York, June 21-25, 1937, represents, as a glance at the subjects will show, the most extensive collection of ideas on the subject ever published in America.

The volume was edited by B. E. Kuechle, Vice-President and Claims Manager of the Employers Mutual Liability Insurance Co., Wausau, Wisconsin, and the subject index was prepared by Mariana Thurber, Chief Librarian of Employers Mutuals.

The table of contents shows the following subjects and speakers: "The Significance of the Silicotic Problem," Dr. L. U. Gardner; "Etiology of Silicosis," Dr. R. R. Sayers; "Dust Concentrations and Their Measurement," Professor Philip Drinker; "Pathology of the Pneumoconioses," and "Correlation of Pathologic and Roentgenologic Findings," Dr. L. U. Gardner; "Physiology of the Fibrotic Lung," Professor W. S. McCann; "Roentgenologic Aspects of the Normal and Silicotic Lung," Dr. E. P. Pendergrass; "Roentgenologic Diagnosis of Silicosis," Dr. H. L. Sampson; "The Clinical Picture and Diagnosis of Silicosis with Consideration of Disability," Dr. A. R. Riddell; "Control-Engineering Aspects," Professor Philip Drinker; "Administrative Aspects of Silicosis," Mr. D. E. Cummings; and "Legislative Control and Compensation," Mr. T. C. Waters.

Since the symposia have been given under the auspices of the Saranac Laboratory for the Study of Tuberculosis, a brief description of the relationships between the Saranac Laboratory, Trudeau Sanitorium and the Trudeau Foundation, as given by Dr. L. U. Gardner, the Director of the Saranac Laboratory, and placed at the beginning of the symposium proceedings, will be of interest to a great many persons.

On account of the inability of Dr. A. J. Lanza to attend this symposium, as originally scheduled, the subject "The Significance of the Silicotic Problem," was given by Dr. Gardner.

Graphs and tabulations have been used with good effect where such data were supplied by the authors of the various papers. Free discussion of all papers is included in the symposium record, which greatly enhances the value of the proceedings.

It is impossible to overestimate the scientific significance of this material; it should be used as a reference volume by all of those who have any need for authentic information concerning silicosis.

The monograph contains 266 pages, can be obtained by applying to Employers Mutual Liability Insurance Company, Wausau, Wisconsin, or the Saranac Laboratory, Saranac Lake, New York, and is priced at $3.00.

Medical Service in Industry and Workmen's Compensation Laws

DR. M. N. NEWQUIST has prepared, and the American College of Surgeons has just published, a 70-page booklet under the above title. In the Preface, Dr. Frederic A. Besley, President of the college refers to the booklet as a "Digest." It *is* a digest, in the best meaning of the term. It covers the two related subjects of its title in a manner that omits nothing of even incidental importance concerning either one; and does this in such a way as to give the reader who reads it as it is presented, a composite picture of both more carefully rounded out and complete than was ever before set forth in a single volume. This is apparent even in the mere outline—which, in itself, has the structure of a textbook, and might well serve as a rule and guide not only of the best way to organize the subjects but also the best way, in point of emphasis where emphasis belongs, to become familiar with them and acquire proper orientation among their various subdivisions. Indeed, the outline of the contents is so suggestive of the careful order of the subject matter, and the studious and experienced treatment of it in all respects, as to be almost a review of the booklet without further words. Thus:

I. Industrial Medicine, Its Purpose and Development:
   Motives.
   Reaction to Adoption of Workmen's Compensation Laws.
   Introduction of Physical Examinations.
   Control of Plant Sanitation.
   Extended Medical Service.

Objectives of Industrial Medicine.
Working Principles of an Adequate Medical Service.

II. Organization of an Industrial Medical Service:
Staff:
Qualifications of an Industrial Physician.
Time Devoted to Service.
Consultants.
Surgeons.
Oculists.
Internists.
Other Specialists.
Dentists.
Nurses, Lay First Aid Attendants, Technicians and Others.
Location, Space and Equipment of the Medical Department:
Location.
Space and Equipment.
Rank of the Medical Department and Interdepartmental Relationships.

III. Functions of the Industrial Medical and Surgical Service:
Pre-Employment Physical Examinations.
Periodic Physical Examinations.
Standardization of Methods of Examination, Records and Classifications.
Diagnosis and Treatment of Industrial Injuries and Occupational Diseases:
Prevention.
First Aid Instruction and Transportation of the Injured.
Use of First Aid Kits.
Dispensary Service.
Medical and Hospital Service Outside of the Industrial Establishment.
Medical and Surgical Service for Non-Industrial Injuries and Illnesses.
Health Preservation Measures.
Sanitation.
Medical Records.

IV. Medical and Surgical Service for Small Industrial Establisments.

V. Illness and Injury Experience in Industry and its Costs:
Relative Proportion of Gainful Workers to Total Population.
Industrial Fatalities.
Injury Rates in Industry:
Injury Rates According to Type of Industry.
Injury Rates by Size of Plants.
Infection of Injuries.
Incidence of Occupational Diseases.
Absenteeism From Illness and Injury.
Length of Hospitalization.
Medical and Compensation Costs:
Costs by Size of Plant.
Costs by Type of Industry.
Distribution of Medical and Compensation Costs.
Other Factors Influencing Medical Costs.

VI. History of Workmen's Compensation Laws:
Early Doctrines as to Liability.
Need for More Uniformity of Workmen's Compensation Laws.

VII. Essential Features of Workmen's Compensation Laws and Insurance Systems and Comments:
Administrative Organization.
Types of Laws and Insurance Systems.
Mode of Election.
Posting of Notices.
Scope of Coverage for Injuries.
Scope of Coverage for Occupational Diseases:
Advisability of Schedule or Blanket Coverage.
Determination of Disabilities.
Employment Exemptions.
Numerical Exemptions.
Exemption of Non-Hazardous Employments.
Exclusions Based on Wages or Salary.
Public Employment.
Extra-Territorial Effect.
Notice of Injury and Claim for Compensation.
Waiting Period.
Scale of Compensation.
Effect of Previous Disability.
Death Benefits:
Dependents.
Funeral Benefits.
Non-Resident Alien Dependents.
Method of Payment of Compensation.
Medical and Surgical Aid:
Periods and Amounts.
Choice of Physician.
States Recognizing Non-Medical Service for Compensable Injuries.
Medical, Surgical and Hospital Fees.
Contribution by Employees for Medical Benefits for Compensable Injuries.
Settlements of Claims and Disputes.
Minors and Incompetent Persons.
Medical Examinations.
Modification of Agreements and Awards.
Commutation of Awards.
Assignment and Exemptions.
Lien or Preference.
How Compensation is Secured.
Suits for Damages.
Injury Caused by a Third Party.
Principal, Contractor, and Sub-Contractor.
Accident Reporting and Prevention.
Penalties.
Rehabilitation.

Among the outstanding features of the text is the following concerning the qualifications of an industrial physician:

"The physician or surgeon who expects to serve an industrial organization, either as the plant physician or as medical director, should be actively interested in industrial medicine and traumatic surgery, and he should possess the the following qualifications:

1. He should be a graduate of an accredited medical school and licensed to practice in the state or province.
2. He should have at least one year's internship in an accredited hospital.
3. He should have some experience in general practice either prior or supplemental to his duties at the plant.
4. He should have a general knowledge of industrial relations, including employment methods and problems, transportation, housing, recreation, educational facilities and methods, and employees' benefit plans.
5. He should be qualified to determine by examination of employees their physical and mental fitness for work.
6. He should have a knowledge of the ingredients and of the toxic or disease-producing qualities of all the materials and processes used in the industrial organization which he serves.
7. He should have a knowledge of sanitation, of working conditions, of accident and occupational disease prevention methods, and of preventive health measures in general.
8. He should have a knowledge of the diagnosis and treatment of occupational diseases.
9. He should be competent in the diagnosis and handling of all traumatic lesions which he undertakes to treat.
10. He should be versed in procedure for follow-up and rehabilitation.
11. He should have a knowledge of the workmen's compensation laws.
12. He should have a knowledge of an efficient medical record system and of statistical methods.
13. He should have an unbiased industrial viewpoint and a confidence-inspiring personality.
14. He should realize that his first duty should always be to the workman whom he examines or treats.
15. He should like people.

"From the above outlined requirements it is evident that industrial medicine is in itself a specialty. A physician may be skilled in medicine or surgery and yet fail to satisfy the administrative or health preservation requirements of an industrial organization. Without such special interests and qualifications the general practitioner or plant physician cannot expect to serve industry adequately as a medical director."

The facility with which so much is said in so little space—the entire book will not exceed 40,000 words—is eloquent of thorough experience and profound knowledge coupled with the somewhat rare ability to invest each part of the subject, even the statistics, with the charm of thought and expression that makes good, as well as instructive, reading. In other words, DR. NEWQUIST knows what he is talking about, has something to say, and says it with compelling concentration on what it is. This "digest," therefore, should be widely read; it will certainly be often referred to.

It is interesting to note that Appendices A and B embody (A) the method for making routine physical examinations of male applicants for employment in industry which was worked out by the NEW ENGLAND CONFERENCE OF INDUSTRIAL PHYSICIANS, and (B) the physical examination procedure developed by the CONFERENCE BOARD OF PHYSICIANS IN INDUSTRY, and published, some time since, by the National Industrial Conference Board.

The forms developed by the COLLEGE (see INDUSTRIAL MEDICINE for March, 1938) are included as Appendices C to G; and Appendix H is the following Annual Statistical Summary:

ANNUAL STATISTICAL SUMMARY
INJURY AND ILLNESS EXPERIENCE—MEDICAL AND COMPENSATION COSTS

Date.....

1. Name of company.....
2. Address .....
3. Nature of industry.....
4. Average number of employees..... Male..... Female.....
5. Number of injuries during the year.....
6. Number of lost time injury cases..... Lost time occupational disease cases.....
7. Number of employees receiving compensation for Industrial injuries..... Occupational diseases.....
8. Injury frequency rate (number lost time injuries x 1,000,000 divided by total man hours worked.).....
9. Injury severity rate (Number days lost x 1,000 divided by total man hours worked).....
10. Working days lost: From industrial injuries..... From occupational diseases.....
11. Number of employees hospitalized for industrial injuries and occupational diseases..... From non-industrial injuries and illnesses..... Total days of hospitalization.....
12. Number of dispensary visits during the year.....
13. Medical and compensation costs (Industrial injuries, occupational diseases, and medical preventive measures for employees only)
    a. Doctors' and nurses' services.....
    b. Hospital service .....
    c. Administration (clerical, etc.).....
    d. Supplies .....
    e. Compensation .....
    f. Total cost (sum of a, b, c, d, e).....
    g. Cost per capita.....
    h. Cost per $100.00 payroll.....

Official Position .....

This book may be obtained from AMERICAN COLLEGE OF SURGEONS, 40 East Erie Street, Chicago. It will be sent without charge, so long as copies are available. If it were permissible to close a comment of this kind with a bit of advice, it would be: "Send for it!"

Meeting Calendar

—1938—

MAY:

TEXAS RAILWAY SURGEONS ASSOCIATION, Galveston, Texas, May 9, 1938. *Secretary,* DR. ROSS TRIGG, First National Bank Building, Fort Worth, Texas.

CENTRAL STATES SOCIETY OF INDUSTRIAL MEDICINE AND SURGERY, Nineteenth Annual Meeting, Springfield, Illinois, May 17, 1938. *Secretary-Treasurer,* DR. FRANK P. HAMMOND, 6308 Cottage Grove Avenue, Chicago. (Program on page 214.)

ASSOCIATION OF SURGEONS OF THE SOUTHERN RAILWAY, Forty-First Annual Meeting, New Orleans, Louisiana, May 24, 25, and 26, 1938. *Secretary-Treasurer,* EDITH A. FOLTZ, Railway Building, Washington, D. C.

JUNE:

AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS, Twenty-Third Annual Meeting, in conjunction with the MIDWEST CONFERENCE ON OCCUPATIONAL DISEASES, Palmer House, Chicago, Illinois, June 6, 7, 8, and 9, 1938. *Secretary-Treasurer,* DR. VOLNEY S. CHENEY, Armour and Company, Union Stock Yards, Chicago, Illinois. (Programs on page 213.)

INSTITUTE OF TRAUMATIC SURGERY, June, 1938. *Secretary-Treasurer,* DR. JOHN D. ELLIS, 122 South Michigan Avenue, Chicago.

SEPTEMBER:

AMERICAN ASSOCIATION OF RAILWAY SURGEONS, Forty-Ninth Annual Meeting, September 19, 20, 21, Palmer House, Chicago. *Secretary,* DR. D. B. Moss, 547 West Jackson Boulevard, Chicago.

ASSOCIATION OF SURGEONS OF THE NEW YORK CENTRAL SYSTEM, Fifteenth Annual Meeting, September, 1938. *Secretary-Treasurer,* H. A. FATHAUER, 413 LaSalle Street Station, Chicago.

NOVEMBER:

SECTION ON RAILWAY SURGERY, Southern Medical Association, Oklahoma City, Oklahoma, November 15, 16, 17, and 18, 1938. *Secretary,* DR. JAMES W. DAVIS, Davis Hospital, Statesville, North Carolina. (Program on page 215.)

NEW YORK STATE SOCIETY OF INDUSTRIAL MEDICINE, Eighteenth Annual Meeting, Albany, N. Y., November, 1938. *Executive Secretary,* FRANK E. REDMOND, 361 Delaware Avenue, Buffalo, N. Y.

DECEMBER:

ASSOCIATION FOR THE ADVANCEMENT OF INDUSTRIAL MEDICINE AND SURGERY, Annual Meeting, New York City, December, 1938. *Executive Secretary,* J. J. BLACKFORD, 370 Lexington Ave., New York.

Injuries to the Knee Joint

—*And Their Treatment*—

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IN DISCUSSING injuries about the knee joint the lesions divide naturally into two large groups.* The first group consists of injuries to the soft structures in and about the knee joint and the second includes the injuries affecting the bony structures which make up this joint.

Common injuries to the soft structures comprising the knee joint include:

1. Lesions of the semilunar cartilages.
2. Ruptures of the crucial ligaments.
3. Sprains or ruptures of collateral ligaments.
4. Traumatic injury to the synovial lining with contusions and hypertrophy of the infrapatellar pad of fat or its processes.
5. Combinations of the above, either with or without accompanying fractures, resulting in subluxations or complete dislocations.

Before considering lesions of the semilunar cartilages let me refer briefly to their anatomy. The semilunar cartilages form two crescentic plates of fibrocartilage which lie upon the peripherial part of the upper articular surfaces of the tibia. In tranverse section they are roughly wedged-shaped with their surfaces corresponding with the articular surfaces to which they are adapted. The attachments of the anterior and posterior horns of the cartilages are by means of dense fibrous tissue to the anterior and posterior portions of the non-articular areas of the upper surface of the tibia. The outer convex border of the cartilage is in contact with the joint capsule from which it obtains a meager supply of blood. This is important, as tears of the outer portion of the cartilage are noted to heal by fibrous union under appropriate treatment. The inner half of the cartilage is entirely devoid of blood vessels and derives its nourishment from the synovium which is a feeble source of supply, and hence tears in this area seldom, if ever, heal.

Lesions of the internal semilunar cartilage occur when a sudden inward rotation of the femur takes place on the fixed tibia with the knee in partial flexion. Lesions of the external semilunar cartilage are produced by external rotation of the femur upon the fixed tibia.

Types of injuries incurred are variable, such as, displacements of the anterior horn, posterior horn or the entire cartilage. More common are the fractures of the cartilage, complete or incomplete, which may be longitudinal, transverse, or oblique. Nearly half of all recorded cases of fractures are of the longitudinal or bucket-handle type, in which cases the torn off fragment is displaced lateral to the internal condyle of the femur.

The symptoms of injury to the cartilages will depend upon the nature and extent of the fracture and whether an original lesion or a recurrent injury has occurred. One should elicit carefully the nature and extent of the original injury, the location of pain, presence or absence of locking, swelling, tenderness, and if audible sounds are heard. On examination one should look for: synovial effusion, limitation of the normal movement of the joint, crepitus and particularly a "click" or "snap," location of the tenderness, and the presence of muscular wasting in recurrent cases of knee injury. In original injuries to the cartilages the symptoms are usually severe at first, while in recurrent cases the tendency is for less reacton as a rule. The reverse may be true, however, and subsequent attacks more marked until definite locking occurs. In original injuries pain, muscle spasm or rapid onset of effusion may mask the mechanical block until swelling and muscle spasm have partially subsided. Pain is usually severe and generalized at first but is most marked over the cartilage. The patient will often describe the sensation as, "something slipped out of place" or, hearing something "snap." Locking, when present, is an important sign, but it does not always occur, as the fractured portion may not be displaced. Even in some cases with displaced fragment there may be little or no mechanical block providing the loose fragment is so displaced as not to interfere with the normal articulating surfaces of the joint. Sudden unlocking is also characteristic of a cartilage injury and gives immediate relief to symptoms. A knee that gradually straightens should be looked on as doubtful cartilage injury. Tenderness is usually located in the joint line over the site of the injury of the affected cartilage. Occasionally a loose cartilage or a lateral narrow strip of the bucket-handle fracture can be palpated along the joint margin. Sprain of the deep fibres of the internal lateral ligament may produce tenderness at this same location and must be differentiated from fractures of cartilages. Therefore, in the absence of locking one may be required to defer definite diagnosis until subsequent behavior of the case reveals the true condition. X-ray examination of the injured knee is essential for its definite value in ruling out other forms of knee injuries or disease.

TREATMENT of the original lesions should be:

1. Reduction by manipulation of any mechanical block due to displaced cartilage.
2. No weight bearing until acute symptoms have subsided, combined with an application of a circular elastic compression bandage, heat, massage and careful active movements.
3. Gradual weight bearing, avoiding rotary movements of the knee joint.

This outline of treatment maintains maximum use of the leg, and there are no recurrences.

Where badly injured cartilages exist and reduction of locking can not be affected, or in recurring cases which indicate a non-union of the fragment, operative removal of the cartilage must be considered. However, this operation should never be lightly undertaken. It requires a high degree of technical skill, careful preparation, and vigorous attention to aseptic technique.

* Read at the Twenty-eighth Annual Meeting of the Surgical Association of the Rock Island Lines, at Fort Worth, Texas, November, 1937.

Sprain or rupture of the internal ligament may occur at its upper or lower attachments or at its attachment into the internal semilunar cartilage causing associated displacement of this cartilage. Injuries to this ligament are produced by strong outward rotation of the thigh when the lower leg is held fixed or by force applied directly to the lateral aspect of the knee or lower thigh. When sprain of the ligament results there is immediate pain and tenderness at the site of the injury followed by edema, effusion into the joint, and frequently ecchymosis and hemarthrosis. Treatment of sprain should not be by prolonged immobilization in a splint but by firm elastic pressure applied to the knee joint. As soon as effusion has appreciably subsided, usually in three or four days, massage and gentle active motion are started.

With complete ruptures of the internal ligament there is severe damage to the stability of the knee joint and proper treatment is imperative. Complete rupture is caused by a more severe force than that which causes a sprain and in addition to the symptoms of sprain there is a very important additional sign of lateral mobility at the knee joint. This may be detected when the leg is in extension by holding the femur fixed, grasping the leg and carrying it outward in abduction. When this is done the leg will be seen and felt to move laterally.

Treatment for this rupture requires restoration and fixation of the knee in its normal position until recovery has taken place. This is accomplished by the application of a closely fitting plaster of Paris cast extending from the groin to the ankle and applied with the leg held firmly in adduction. The patient should be allowed weight bearing as desired. In severe tears the cast should be retained for 10 to 12 weeks. Open operation for suture of this ligament is unnecessary in recent cases, as perfect healing and recovery of the joint occur with this treatment.

Following severe injuries to the internal lateral ligament with hemorrhage or periosteal tearing a calcification or ossification at the upper angle of the ligament may be seen in an x-ray. This is called Pelligrini Steida's disease. It is usually symptomless and only found several weeks after injury by the check-up x-ray.

Treatment is necessary only in those cases in which the ossification causes a painful shortening of the ligament and should consist of plastic lengthening of the tendon only. Removal of the body is not successful, as recurrence is the rule.

Atypical cases show a similar condition in other portions of the ligament but are symptomless.

Ruptures of the external lateral ligament are not commonly seen; more frequently avulsion of the head of the fibula occurs.

It must be remembered that the lower attachment of the external lateral ligament is not into the upper tibia but onto the head of the fibula. Hence, avulsion of this head produces the same signs as rupture of the ligament, namely, lateral mobility of the knee inward on adduction. Treatment for rupture of the external lateral ligament follows the same principles as set forth in rupture of the internal ligament. Treatment for avulsion of the head of the fibula is invariably operative as the bone fragments are frequently separated an inch or more. Replacement and fixation of the head must be made to obtain stability in the joint.

Case 1. This patient was injured by slipping from a step, throwing the leg into adduction. She was first seen eight weeks after injury, walking on crutches and unable to bear more than a few pounds of weight on the injured leg. There was marked lateral mobility of the knee joint and x-ray examination showed three-quarters of an inch separation of the head of the fibula. Open repair was made by removing the interposing fibrous tissue between the ends of the bones, and maintaining position by silver wire. The use of silver wire was indicated because marked tension was necessary to hold the head in place at this time. Complete recovery followed, and in six months the joint was stable with restoration of function.

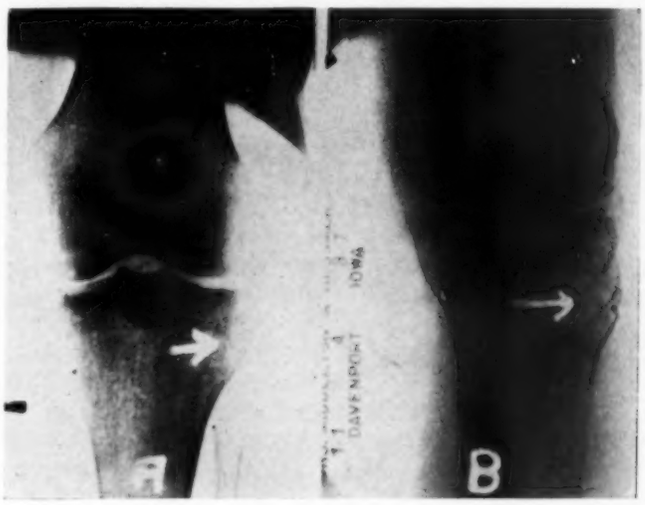

Fig. 1.
A. Illustrates avulsion and separation of the head of the fibula from the shaft. Tear of the external collateral ligament of the knee occurs by the same mechanism when avulsion does not take place
B. Shows the same case after wiring of the fibular head. Healing has occurred

Injury to the crucial ligaments of the knee joint are usually the result of a violent force and occur most commonly with dislocations. Rupture of the anterior crucial ligament is seen occasionally with ruptures of the internal lateral ligament occurring by a more severe degree of injury.

This same force at times produces, not a tear in the fibers of the anterior crucial, but avulsion of its insertion into the inner tubercle of the tibial spine. The anterior crucial is taut when the knee is in extension and its function is to prevent forward movement of the tibia on the femur or hyperextension of the knee joint. To determine this, place the leg with the knee bent to about 150° of extension and the heel resting on the table. Grasping the upper third of the leg an abnormal mobility forward will be noted in ruptures of this ligament. It will also be noted that the leg can be hyperextended farther than the opposite leg.

The posterior crucial is taut on extreme flexion of the knee and its function is to prevent back-

ward displacement of the tibia on the femur. In grasping the upper third of the leg, as indicated previously, there will be abnormal mobility backwards in tears of this ligament. These are usually caused by violent flexion of the knee combined with an additional force displacing the tibia backwards.

TREATMENT of recent ruptures of the crucial ligaments and injury to the tibial spines should be prolonged immobilization. The joint should be completely immobilized for eight to 10 weeks. Massage of the quadriceps muscle should be kept up regularly but no movement of the joint permitted. Movements of the hip and ankle joints should be encouraged. When movement of the knee joint is started a knee cage should be worn for a period of time. Operative repair in recent cases of crucial ligament injury is unnecessary. In old cases operative repair may be made by reconstruction of the crucial ligaments with strips of fascia lata.

Synovial reaction to trauma is by means of inflammatory hyperemia, edema and effusion. This tends to subside with rest. At times the infrapatellar fat pad and its projections are subject to further trauma by repeated impingement as the knee joint extends. This is especially true when its attachment, the ligamentum mucosum, is torn and the fat pad allowed to swing under either condyle. This causes a pseudo locking early because of pain, but later after massive fibrous tissue is incorporated in the fat pad actual locking may occur. Treatment early is rest with aspiration if there is marked effusion. Later, if marked hypertrophy, surgical removal of the fat pads becomes necessary.

Complete dislocations of the knee may occur in all four directions. The most common is toward the lateral side. More frequent than dislocation is a subluxation of the joint which is seen associated with either a fracture of a femoral condyle or a tibial tuberosity. Dislocations of the knee joint are only possible when the crucial and collateral ligaments are partly or completely ruptured. Occasionally the vessels and nerves on the posterior aspect of the joint are torn. If rupture or thrombosis of the major vessels occur, immediate amputation of the leg should be performed. Torn nerve trunks must be sutured. Reduction of dislocations is best accomplished by traction on the leg and direct pressure against the dislocated part. This causes less injury to vessels and nerves. Particularly should hyperextension and over-stretching of the vessels be avoided. There is usually marked effusion and hemorrhage into the knee joint. This, as in all knee injuries when present, should be removed by aspiration and a compression bandage applied. At the end of a week a snug fitting plaster cast should be applied from the hip to the ankle joint. Weight bearing and use of the leg in this cast should be started early. The cast should not be removed before eight to 12 weeks depending upon the severity of the ligamentous tear. The prognosis, with this treatment, is quite good, as the ligaments heal and muscle strength is maintained.

The more common fractures involving the knee joint are fractures of the patella, fractures of the internal and external tuberosities of the tibia and condylar fractures of the distal end of the femur.

Fractures of the patella usually can be very definitely placed into two classes.

Class one is the so-called intracapsular fracture. These fractures may show a transverse or longitudinal crack or may reveal irregular comminutions, but have no separation of the fragments or tearing of the investing capsule. Treatment consists of protection of the knee joint for four to six weeks and motion to prevent adhesions.

Class two is the common type of patellar fracture. These have separation of the patellar fragments and a corresponding tear extending laterally through the vastus medialis and lateralis tendons. In other words separation of the entire extensor mechanism of the knee joint has taken place. Full restoration of extensor function can be obtained only by plastic repair of these tendons. The old method of long continued fixation in hyperextension usually resulted in an elongated extensor mechanism leaving the knee joint relaxed and the patient subject to frequent falls. Optimum time for operative repair is at the end of one week, but this should never be done until compounded wounds and superficial abrasions have healed. The opening of this joint should be undertaken only under the strictest of aseptic technique. A U-shaped flap curved downward over the distal end of the patella and reflected upward gives good exposure to the fractured patella and torn tendons. Repair consists of removing the extensive blood clot between the torn fragments of tendon and bone and washing out the blood clot from the knee joint by irrigation with warm salt solution or very weak bichlorid solution. Next and of paramount importance is the bringing together and suturing of the tendons of the vastus medialis and lateralis with heavy chromic mattress sutures. This brings and holds the intracapsular patellar fragments in good apposition. Whether the bone itself is sutured or encircled with silk or wire is of less importance, as a good functional result occurs in the use of the extensor mechanism when these tendons have been properly sutured.

If the distal or proximal fragments of the patella are small or badly comminuted they are better removed. The aponeurosis of the rectus muscle which forms the anterior layer of the patellar capsule is then sutured by strong interrupted chromic catgut. The skin flap is then resutured and a snug well-padded compression bandage is applied to the wound to prevent hemorrhage under the flap. Last of all the tourniquet is removed. The compression bandage may be released in a few hours if causing pain. The leg can be immobilized in a posterior splint or cast. Massage of the quadriceps should be instituted early to preserve its function and daily lateral movement of the patella should be done to prevent adhesions to the femur. Straight weight bearing on the leg

should begin in eight days, but the splint should not be permanently removed until three weeks postoperative. At this time active movements of the leg in flexion and extension are used and complete recovery is had in six to eight weeks.

In the upper end of the tibia we see a variety of fractures involving the knee joint. These fractures occur most commonly by direct blows to the side of the knee joint but may be produced also as a compression fracture of the articular surface from vertical force through the knee joint.

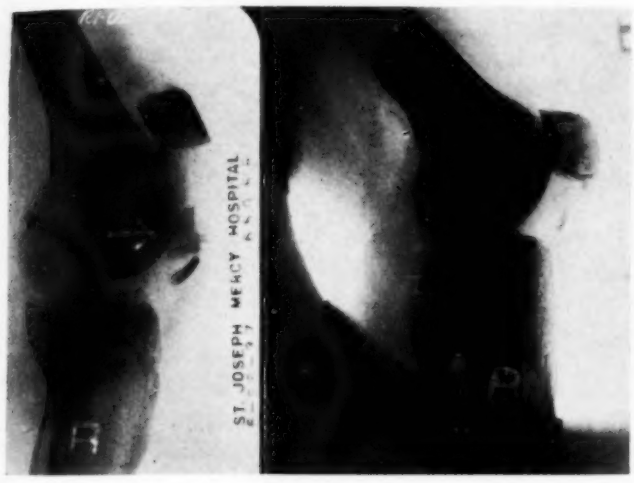

Fig. 2.
Illustrates fracture of the patella in which the smaller fragment, (indicated by arrow in A) has been removed, as seen in B. This case had a complete restoration of normal function

The most common type seen is the fracture of the external tuberosity. This fracture occurs from a blow against the outer side of the knee joint. It does not rupture the internal lateral ligament and the force is transmitted from the external condyle of the femur downward against the outer articular surface of the tibia. Usually a rather large fragment of the outer tuberosity is forced downward and outward. These fractures result in considerable disability if they can not be reduced because of the change in the level of the joint line. In walking the tibia then articulates with the femur at an angle and the knee joint is either in varus or valgus depending upon which condyle has been involved.

Fig. 3.
A. Shows widening of tibial plateau due to fracture of external tuberosity. There is some depression
B. Shows same case with plateau level replaced and resultant healing

There is usually hemorrhage into and marked swelling about the knee joint. Treatment of this fracture consists in replacing the fractured fragment up to the normal joint level.

Fig. 4.
Shows depression and comminution of the lateral tibial tuberosity in both anterior-posterior and lateral views

Elevation of the fragment to the normal joint level may be obtained when the normal angulation of the leg is restored by forcefully adducting the leg and at the same time applying manual pressure against the fragment. If this fails a padded knee clamp may be used to compress the fragment into alignment.

A close fitting plaster cast is then applied from the ischial tuberosity to the ankle while the leg is held strongly in adduction. Early weight bearing is permitted and the cast is removed in eight to 10 weeks.

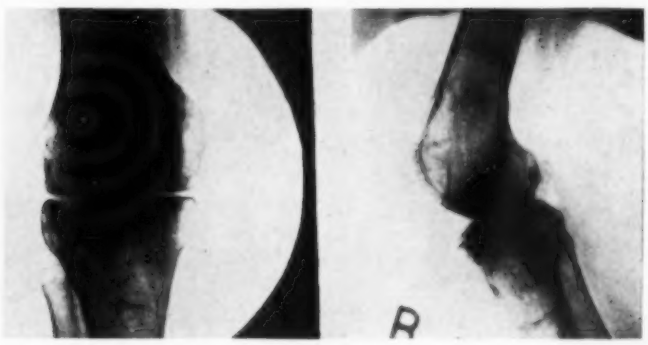

Fig. 5.
Shows same case as Fig. 4. The larger lateral fragment has been elevated, compression and healing have occurred. Note: Although there is still a depression of a portion of the joint surface, the lateral margin is elevated sufficiently well to give good weight bearing and normal joint function

Fractures of the medial tibial tuberosity occur more rarely because its position makes it less vulnerable. Treatment follows along the same lines except that the maneuvers are carried out in the opposite direction and the plaster cast is applied with the lower leg held as much as possible in adduction. Occasionally in compression types of fracture to the tibial articular surface, the frag-

ment is compressed into the spongy bone. These cannot be reduced and if the displacement is very marked open operation is necessary to restore the depressed fragment. This is accomplished by a lateral incision below the joint level and with the broad osteotome driven along under the fractured fragment, the fragment can be elevated. It usually is necessary to insert a bone graft into this space as a wedge to maintain the elevation of the fragment.

Fig. 6.
Shows anterior-posterior and lateral of a fracture of the lower end of the femur with comminution

Comminuted fractures of the entire head of the tibia with more or less lateral displacement of both internal and lateral tuberosities are seen with impaction of the shaft into these fragments.

Skeletal traction is necessary for reduction of these fractures and maintenance of position during the healing period. The marked lateral displacement of the fragments may be overcome by use of lateral pressure with a knee clamp.

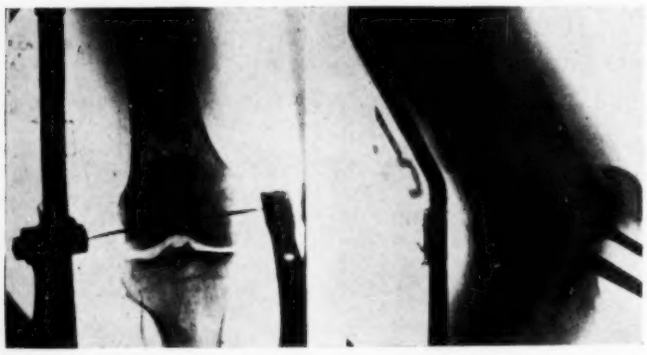

Fig. 7.
Shows same fracture as Fig. 6 and illustrates how fragments may be replaced with only the use of a Kirschner wire and traction

Fractures of the lower end of the femur into the knee joint are of two types. The more severe is the T or Y fracture frequently seen with displacement or comminutions of the condyles, and the second is the fracture of all or part of one of the condyles.

If only the medial or lateral condyle is broken off the fragment is displaced upward and the lower leg is in a varus or valgus position depending on whether the medial or lateral condyle is displaced. Correction of this displacement is made by pulling the lower leg in the opposite direction to that of the broken condyle and this condyle is then drawn down by the intact lateral ligament of the joint. Immobilization in plaster of Paris cast is maintained for six to eght weeks. Occasionally fracture of part of one condyle occurs. The fragment lies free in the knee joint and replacement of this fragment is impossible without open reduction.

The object of treatment in T or Y fractures of the lower end of the femur is to restore the condyles to their normal position and maintain this position by the use of skeletal traction with the leg placed on a Braun frame. For traction some operators prefer the use of a Steinman pin through the head of the tibia. However, if it is possible to apply it, a much more satisfactory result will be obtained if a Kirschner wire can be passed through the condyles just above the knee joint after the reduction has been made. The advantage of this procedure results from the fact that the leg is left free and early mobilization of the knee joint can be had.

Suction Tonsillectomy

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TONSILLECTOMY is the most commonly performed of all surgical operations today, and it is also the operation most often imperfectly performed. In the hands of an expert operator some tonsil operations are comparatively easy of performance, but occasionally difficulties are encountered which tax the abilities of the most expert, and against which the operator of average experience and ability is hard put sometimes to handle successfully. Death from hemorrhage is not a common occurrence in tonsil surgery, but alarming hemorrhage often difficult to control is fairly common. Other complications of more or less grave moment are postoperative pneumonia and lung abscess.

It may be said that most of the difficulties and dissatisfactions of present day tonsil surgery can be absolutely eliminated, and have been so eliminated, but not with the commonly employed dissection or cutting-out technic.

In 1909 the late Greenfield Sluder brought out the Sluder technic, which was rapid and highly spectacular in his hands, but it was a very difficult technic for the average operator to master, and it was applicable only to a certain percentage of tonsils, and hardly suited to local anesthesia operation. Because of these inherent difficulties the Sluder technic has gradually suffered a marked decline, so that today it is rather rarely encountered. This state of affairs necessitated a fall back upon the time-honored cutting-out or dissection method of tonsil operation, which at least had the point in its favor that it was applicable to all types of tonsils, and is used for both local and general anesthesia operation. How-

ever, the method has always had a number of inherent difficulties and shortcomings. Except in very minor degree these difficulties and deficiencies are part and parcel of the operation and cannot be eliminated: hemorrhage; injury to pillars or uvula; incomplete removal; postoperative pneumonia and lung abscess; often unduly painful and prolonged convalescence. Because of these difficulties it is distinctly a hospital procedure. Basically there is very little difference between so-called sharp and blunt dissection, and free bleeding is often encountered with both methods. There has been but minor improvement in the basic technic in the past decade or so.

Simply because nothing better was available, many operators have continued to "dissect" tonsils, and for the same reason it is the method most commonly taught in our hospitals and clinics. Electro-coagulation removal of tonsils had a sharp rise in favor, aided perhaps by rather intensive propaganda by the manufacturers of the various high frequency electrical machines; but it is a highly specialized procedure requiring both surgical and electro-surgical knowledge and experience, and is too time-consuming for routine tonsil removal. It is also hardly applicable to use in children, who constitute the majority of tonsil patients. For removal of stubs and tags from incomplete surgical removal, however, electro-coagulation is the method par excellence, and every operator should master the technic thoroughly for selected case usage.

Suction tonsillectomy was developed with the idea of elimination of the admitted deficiencies of dissection technic. When first presented to the profession in 1922 in a preliminary article, the technic consisted largely of a basic idea which was sound. In the following years, however, the equipment and the technic have been slowly perfected and brought to a state where the operator taking up suction tonsillectomy today is assured of perfect equipment, perfect technic, and a tonsillectomy so satisfactory in all respects that it has to be seen to be appreciated.

A PERFECT tonsillectomy should remove the tonsils cleanly and easily in capsule without damage to pillars, uvula or underlying throat structures. It should be fairly rapid, and it should be so practically bloodless that hemorrhage may be dismissed from consideration as a complication. It should be applicable to all types of tonsils and used equally well with general or with local anesthetic. Convalescence should be easy and uneventful, and such grave complications as postoperative pneumonia and lung abscess should be eliminated. Further it should be a basically simple technic which any operator of average skill is able to master without undue effort.

Suction tonsillectomy answers these requirements perfectly, and this explains why operators all over the country are discarding the old "cutting-out" methods, taking up the newer suction tonsillectomy technic, and rapidly becoming so enthusiastic over its merits that all thought of a return to the older technic is emphatically discarded.

It must be emphasized, however, that the operator should start with perfect equipment. No operator would attempt a cataract operation without proper equipment therefor, and it is equally futile to take up suction tonsillectomy without proper air pump equipment, instruments and technic. In practically every instance where operators have failed to get perfect results it will be found they have attempted the operation with makeshift equipment, or have failed to follow accurately the simple technic.

The air pump preferred is a Robertson Duplex electrically-driven, foot-switch controlled compressed air and suction pump, with a special hook-up designed for suction tonsillectomy. Two separate suction lines are used, one for independent use of the saliva aspirator, which hangs alongside the operative table head suspended from a sliding runner on an overhead cable so arranged as to keep it about a foot away from the similarly suspended operative suction line which is next in line towards the foot of the table. The third line is from the pressure side of the pump, which pumps air through a bottle of ether, the third on left, and is carried by flexible rubber tubing to an ether hook which is dropped into the corner of the patient's open mouth, entirely out of the way.

The operative suction line is controlled by a needle valve and gauge control, and gives from 25 to 30 inches of suction at sea level. In use the needle valve control is kept closed tightly, full suction being on at all times, and accurately controlled in the course of the operation by the foot-switch.

I cannot emphasize too strongly that for perfect operation foot-switch control of the air pump is an absolute necessity. A hand-switch on the face of the motor may be used at times independently of the foot-switch, but for most part the foot-switch controls. Compressed air up to 60 pounds pressure may be obtained with the needle valve control closed down completely, but, in

general, air pressure is run at five to 10 pounds for general anesthesia in children, and at 15 to 20 pounds pressure for adults.

In front of the pump proper are mounted, from right to left, two suction reservoir bottles and an ether vapor bottle with a special head attachment. Such reservoir bottles are an absolute necessity to prevent mucus or blood being drawn into the pump, and the flexible rubber tubing to their intakes is suspended alongside the operative table from an overhead wire conveniently at hand for the operator at all times. The pump is a powerful, heavy-duty, slow-speed one which develops full suction almost with its first revolution, and it is actuated by a powerful over-sized motor. With proper attention to lubrication there is no

wear-out to this pump, and it will give years of efficient day-in and day-out service. Where portability is desired, the table model is preferable, but where the pump is to be kept continously in hospital or clinic the cabinet model is indicated, mounted on easy running rubber casters so that it can be moved from place to place in the building. In operation the pump is placed to the right of the operative table, across from the head of the table, facing it and about two feet away from it. The foot-switch is placed conveniently on the right side of the head of the table available under the foot of the operator.

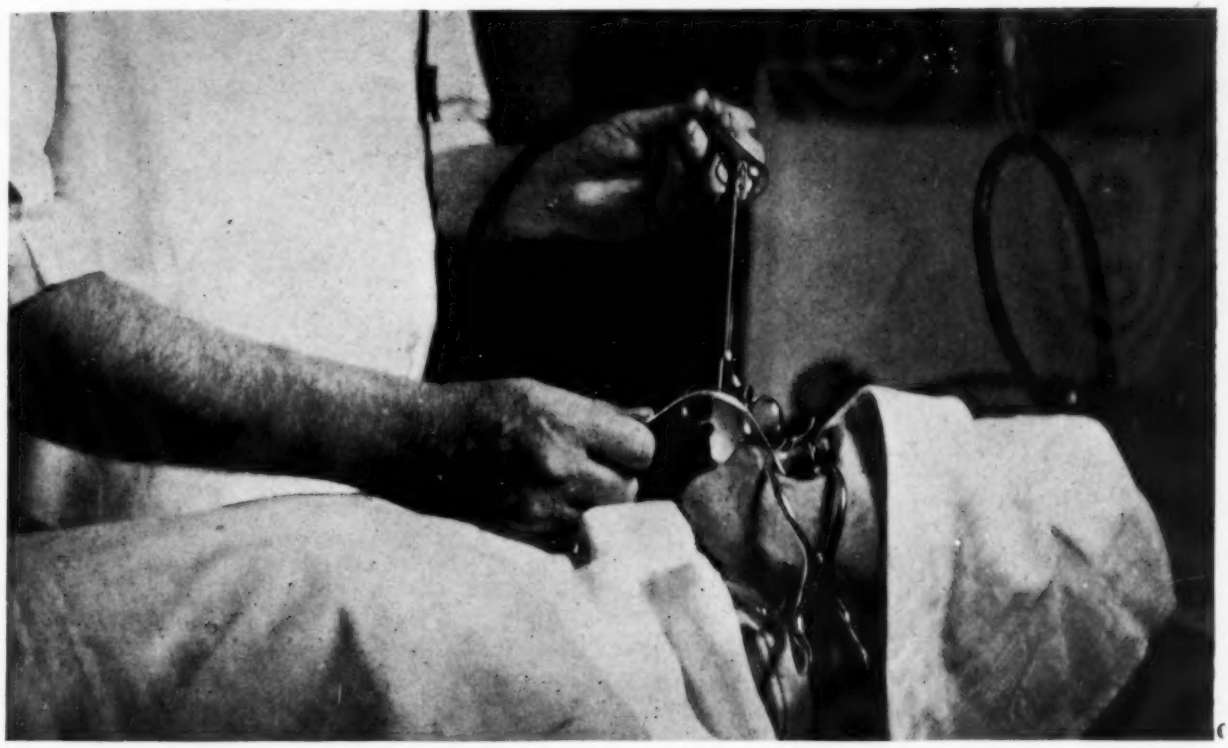
DETAILS of pre-operative treatment will be omitted here. For general anesthesia operation a simple anesthesia technic which is applicable to all cases, has been developed and will be briefly described. No pre-operative sedation is employed, and we omit the time-honored taping of the patient's eyes, greasing of the nose and mouth, etc. A towel may be lightly laid over the patient's eyes after the procedure has been briefly illustrated to the patient.

With the patient in the recumbent position, an open Yankauer chloroform mask is placed over the nose and mouth and ethyl chloride dropped on, drop by drop, the patient being instructed to count slowly as high as he or she can before losing consciousness. Usually the patient is able to count out loud to 30 or 40 before losing consciousness, and without any appreciable excitement stage. The ethyl chloride is then discontinued and ether by drop method exhibited rapidly on an open cone until all ethyl chloride has had time to evaporate. Then a Waring hood is placed over the Yankauer cone and drop method ether continued from an anesthesia arm to a stage of light surgical anesthesia. Then the operator at right head of the table inserts a Jennings type mouth-gag; drops in the ether hook in the right hand corner of the patient's mouth and runs ether vapor by the foot-switch until the gag reflex is quieted down. We are then ready to remove the tonsils, usually the right first.

In suction technic, suction developed from the air-pump is applied through a glass-rubber tonsil tube of special design to stretch adhesions and to lift the tonsil out of its fossa between the pillars and into the bulbous mouth of the suction tube, so that a previously adjusted snare loop may be carried down the shaft of the tonsil tube, over its bulbous head and in back of the tonsil. Drawn taut by direct pull on the trigger of the ratchet-type Pierce-Mueller tonsil snare, the ratchet trigger is thrown back and the snare loop slowly tightened down by turning the ratchet wheel on the end of the snare. When this is completely drawn into the mouth of the snare canula the tonsil is mushroomed and enucleated cleanly in

its capsule, grasped firmly in the mouth of the tonsil tube, and removed with the snare from the patient's mouth. The perfection of this enucleation and its remarkable rapidity are almost unbelievable.

While any tonsil snare may be employed, this ratchet-type snare has certain very pronounced advantages, and should be employed for the best results. No. 9 snare wire of the finest quality is employed, and, as the entire enucleation is performed by this snare loop, its proper adjustment beforehand is of vital importance and should never be entrusted to an untrained assistant or nurse; in fact this is a function the operator had best perform himself in every instance. The



heavy snare wire employed, and the ratchet use, give a crushing or pinching rather than a cutting action; and partly explain the practically bloodless nature of the operation. Instead of being cut across, capillaries going into the tonsil proper are crushed and pinched through, and promptly seal and in consequence free bleeding is conspicuously absent.

After prolonged study a change of ideas has developed, and in view of the simple, efficient and very easy anesthetic used, general anesthesia operation is now the method of choice, except in a comparatively few cases where there are special indications for local operation. With general anesthesia it is possible to lift out the tonsils two or three times prior to enucleation proper, and thus in old quinsy cases and others with dense adhesions, stretch these adhesions beforehand so that perfect enucleation is a certainty.

One of the strongest features of the operation is that the minute the tonsil is suction-grasped in the mouth of the tonsil tube, all free pus and gross masses of crypt exudate are vacuum-cleaned from the tonsil and carried out of the throat into the reservoir bottle; not only this, but the tonsil itself serves as a tight stopper to the mouth of the suction tube bulb so that there is no possibility of this potentially infective crypt debris being aspirated into the lower air passages, many times with resultant lung abscess or postoperative pneumonia. So important is this safety measure, which is an integral part of the suction technic, that all tonsil operators are earnestly urged thus to suction-cleanse all tonsils before commencement of the enucleation technic proper. Not only does this procedure not interfere with whatever subsequent technic is to be employed, but it actually makes dissection far easier by its stretching of dense adhesions which otherwise would have to be cut through to free the tonsil sufficiently for snare play. Further than this, it takes not half a minute thus to suction-cleanse a tonsil, and this is certainly worth a minute or two of any operator's time if it will prevent these grave complications of aspiratory origin—and that it does so is evidenced by the entire absence of lung abscess and postoperative pneumonia with many thousand suction tonsillectomies by hundreds of different operators.

Some operators have the idea that suction tonsillectomy is all right with the hypertrophied tonsils of children, but is not applicable to the small, buried, and badly adherent tonsils of adults. This idea is entirely erroneous. In fact suction tonsillectomy is at its best and most spectacular in just the type of tonsils which usually eventuates in a bloody mess when dissection attempt is made. In fact the ease, the rapidity and the perfection of enucleation in many of these apparently tough

cases have to be actually seen to be believed.

It should be emphasized that for perfect enucleation the tonsil *must be* completely lifted from its fossa before snare play. If only part engages in the tonsil-tube mouth the snare loop will slice through and require a second engagement and removal of the stump thus left. If too small a tube is employed it becomes impossible completely to lift the given tonsil, but on the other hand the use of too large a tube may cause straddling of the pillars and injury to them. For that reason a tube size must be selected which is proper for the given tonsil, and with a very little experience the operator quickly learns to size up a given tonsil and use the proper size tube.

The snare loop is adjusted perpendicular, finger fashioned broadly oval with its long diameter corresponding with the longest diameter of the tube and bowl and large enough so that it will slide smoothly over the bulbous head of the tonsil tube. For the right tonsil the snare loop is bent towards the right at an angle of 45°; for the left the same angle to the left. This insures easy and practically automatic travel of the snare loop over the bulbous head of the tube to its seat back of the tonsil.

For safety's sake, where indicated the tip of the uvula is engaged beforehand with a Judd-Allis tissue forceps which is kept in situ until the snare loop is seated back of the tonsil and then removed. Where the posterior pillar is badly adherent to tonsil, its margin may be grasped by a Waring-modified curved Judd-Allis forceps in such fashion as to protect both uvula and posterior pillar. Such protection is indicated more in small-throated children, but occasionally is useful in adults.

As a tonsil is enucleated, an oversized cotton sponge on sponge forceps is placed in the fossa and held under pressure for a minute or so; sometimes two or three are similarly placed, and on removal the fossa is found to be practically dry. If an oozing point is located it is compressed with a Herbert tonsil hemostat and rarely requires any further attention. Very, very rarely in this operation is ligature or suture required, and blood loss is negligible. With removal of the first tonsil and a dry fossa, the second tonsil is removed in the same fashion and the fossa carefully examined for perfection of enucleation and dryness. Then the patient may safely be placed in bed. Owing to the remarkable rapidity of the operation only a very light and brief anesthesia is required, sufficient ether vapor being supplied by the pump to keep the gag reflex quiet for the two or three minutes required for removal proper.

Recovery from anesthetic is in consequence very rapid, and there is a minimum of postoperative nausea and discomfort. Likewise convalescence is shortened by half, and without complications. For the first 12 hours the patient is given a powder dropped on the tongue every three hours when awake; each powder contains 1/32 morphin in milk sugar and suffices to control postoperative pain without the undesirable side effects of opium in larger dosage. Liquid and soft diet for two or three days with restricted physical exertion, and convalescence is complete in half the time of the usual tonsil operation.

For local anesthesia operation the technic is the same except that the patient is seated in a chair. The throat is prayed with 2% butyn until throat reflex is quieted down a bit; then peritonsillar injection is made of a solution of 2% novocain; 1% antipyrin; and 1% (1-1000) epinephrin. This insures satisfactory local anesthesia in about 10 minutes, and first one tonsil and then the other is removed. Instead of placing cotton tampons on the fossae the patient is instructed simply to lean forward with the mouth open slightly and to breathe quietly. By gravity saliva and mucus drool for a minute or so when as a rule the fossa will be found perfectly dry; if not it is carefully sponged with a cotton applicator and the Herbert hemostat applied briefly to any oozing point. The second tonsil is removed in the same manner and after it is seen that both enucleations are perfect and the fossae dry the patient is put to bed, reclining on the right side as a rule, so that, with the mouth slightly open and downwards, saliva can drool by gravity and thus save the patient the effort to expectorate. While convalescence is usually as rapid and uneventful with local as with general anesthesia, prolonged observation seems to indisate that local anesthesia patients complain of postoperative sore throat more than do those taking general anesthesia, but in neither class of patient is undue discomfort complained of, and discomfort is usually controlled easily with one of several anesthetic throat lozenges available.

No effort has been made in this brief paper to go into minutiae as to the successive steps in technic. It may be emphasized in closing, however, that with proper equipment and correct technic suction tonsillectomy offers to every operator of average ability a tonsillectomy which completely eliminates the difficulties and dissatisfactions and dangers of the commonly employed cutting out methods; that with either general or local anesthesia it affords an operation applicable to all types of tonsils; and that, what is more to the point, it removes the tonsils easily, cleanly and rapidly, and with a practical absence of free bleeding or other disturbing complication.

It is believed that an operator taking up the suction method should first witness the operation as performed with proper equipment and technic; then properly equip himself, and he is ready to proceed safe in the knowledge that he will acquire results that are as satisfactory to the patient and family as they are to the operator.

Especially should the operator be certain that he equips himself with correctly made tonsil suction tubes, as success of the operation largely depends on suction tubes of the proper type and quality; and in the past quite a few imitation suction tubes have been foisted upon the market by unscrupulous manufacturers, faulty in design and so fragile as to be dangerous to use.

Given proper equipment and correct technic perfect results are assured on all types of tonsils, either under general or with local anesthesia operation.

The June Programs

—Twenty-Third Annual Meeting of the American Asssociation of Industrial Physicians and Surgeons, and Second Annual Midwest Conference on Occupational Diseases: Tentative Programs—

THE programs for the Twenty-Third Annual Meeting of the AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS, and the Second Annual MIDWEST CONFERENCE ON OCCUPATIONAL DISEASES, at the Palmer House, in Chicago, on June 6, 7, 8, and 9, 1938, can now be set forth as follows, subject to certain additions which will be announced in our issue for May:

Monday, June 6:

UNDER the general heading of "Industrial Hygiene," there will be these presentations, in addition to others to be announced later:

"The Physician's Responsibility in Industrial Hygiene," by CLARENCE D. SELBY, M.D., Medical Consultant, General Motors Corporation, Detroit.

"The Insurance Carrier and the Control of Occupational Diseases," by J. B. LAMENZO, Research Engineer, Hartford Accident and Indemnity Company, Hartford.

"The Estimation of Potential Occupational Disease Hazards, and of Their Control," by J. J. BLOOMFIELD, P. A. Sanitary Engineer, U. S. Public Health Service, Washington, D. C.

"The Engineer's Place in Industrial Hygiene," by WARREN A. COOK, Superintendent, Engineering Department, Zurich General Accident Insurance Company, Chicago.

Tuesday, June 7:

THIS day's presentations include: "Contact Dermatitis," by MICHAEL EBERT, M.D., Associate Professor of Dermatology, Rush Medical College, Chicago.

"Analysis of the First 200 Cases Under the Illinois Occupational Diseases Law," by CLARK D. BRIDGES, Safety Director, Casualty Mutual Insurance Company, Chicago.

"Noise in Industry," by WALLACE WATERFALL, Fellow, Acoustical Society of America.

"Developments in Occupational Diseases Legislation," by OLIVER G. BROWNE, General Claims Attorney, New York Central System.

"Women in Industry," by M. H. KRONENBERG, M.D., Director of Industrial Hygiene, State of Illinois Department of Public Health.

"Effect of Light in Industry," by DR. M. LUCKIESH, Director, Lighting Research Laboratories, General Electric Company, Nela Park, Cleveland.

"Tuberculosis in Industry," by O. A. SANDER, M.D., Milwaukee, Wisconsin.

"Employability of the Silicotic," by VOYTA WRABETZ, Chairman, Industrial Commission of Wisconsin.

Wednesday, June 8:

THE morning session will include:

"Factors Determining Reasonable and Equitable Total Disability Period," by PHILIP H. KREUSCHER, M.D., F.A.C.S., Regional Chief Surgeon, Carnegie-Illinois Steel Company, Chicago.

"Hazards of Night Driving," by HART E. FISHER, M.D., F.A.C.S., Chief Surgeon and Medical Director, Chicago Rapid Transit, and related companies.

"Syphilis in Industry," by HAROLD A. VONACHEN, M.D., Medical Director, Caterpillar Tractor Company, Peoria, Illinois.

"The Occupational Diseases Research Department of Northwestern University Medical School," by JAMES A. BRITTON, M.D., Supervisor of Medical Service, International Harvester Company, Chicago.

The afternoon session—with the Component Society participation of the ASSOCIATION FOR THE ADVANCEMENT OF INDUSTRIAL MEDICINE AND SURGERY—will include:

"Arthritis in Industry," by JOHN DEPAUL CURRENCE, M.D., New York City.

"Tuberculosis in Industry," by GEORGE G. ORNSTEIN, M.D., F.A.C.P., New York City.

"Intra-Articular Damage," by WILLIS W. LASHER, M.D., F.A.C.S., Chief Surgeon, Employers' Liability Assurance Corporation, New York City.

"Lead Poisoning in Industry," by IRVING GRAY, M.D., F.A.C.P., New York City.

Wednesday evening will be given over to the ANNUAL DINNER.

Thursday, June 9:

THE morning session—with the participation of the INSTITUTE OF TRAUMATIC SURGERY—will include:

"A Discussion of Fat Embolism," by CARLO S. SCUDERI, M.D., Chicago.

"Trauma to Blood Vessels, and Their Sequelae," by R. W. MCNEALY, M.D., Chicago.

"Distinction between Injuries of the Spine, Spondylitis, and Spondylosis," by JOHN D. ELLIS, M.D., F.A.C.S., Chicago.

"Pectin in the Treatment of Wounds," by JAMES E. M. THOMSON, M.D., Omaha, Nebraska.

"Metallic Fixation of Bones," by WILL F. LYON, M.D., Chief Surgeon, International Harvester Company, Chicago.

The afternoon session will include a "Symposium on Fractures," which will be a joint meeting with the Regional Fracture Committee of the AMERICAN COLLEGE OF SURGEONS.

Collaborating Organizations

THE collaborating organizations now include: State of Illinois, Division of Industrial Hygiene;

Department of Public Health and Hygiene, University of Illinois College of Medicine;

Chicago Society of Industrial Medicine and Surgery;

Institute of Traumatic Surgery;
Board of Health, City of Chicago;
Occupational Diseases Research Department, Northwestern University Medical School;
Industrial Hygiene Unit, Wisconsin State Board of Health;
National Safety Council;
Greater Chicago Safety Council;
Chicago Dermatological Society;
Bureau of Industrial Hygiene, Detroit Department of Health; and
Department of Health, State of Michigan.

Central States Program

THE Nineteenth Annual Meeting of the Central States Society of Industrial Medicine and Surgery will be held in Springfield, Illinois, Tuesday, May 17, 1938.

The Illinois State Medical Society's Annual Convention will be held May 17, 18, and 19; and the Central States Society's afternoon session will be held in conjunction with the Surgical Section of the Illinois State Society.

The Central States' program, under the direction of Dr. James J. Callahan, Program Chairman, will be as follows:

Morning Session:

1. "Medicolegal Aspects of Occupational Diseases," by C. O. Sappington, M.D., Dr.P.H., Consulting Industrial Hygienist, Chicago.

Abstract:

IN THIS annual review of medicolegal experiences with occupational diseases, statistical comparisons will be made of the 1936 and 1937 figures with regard to compensation cases and court decisions in various states. As will be demonstrated, there are great differences.

Reference will be made to the present legislative requirements relative to coverage, and the rights of employers and employees, particularly with respect to common law actions and the availability of common law defenses. Because dust diseases continue to be important and cause the greater number of decisions, this type of occupational disease will be considered separately.

The common occupational diseases for which provisions are generally made in different states will be mentioned, and the relationship of the physician and surgeon discussed.

Summary and recommendations will provide a basis for future medical and legal procedures in this important field.

(This presentation will include lantern slides.)

2. "Recognition of Early Tuberculosis in Industry," by James A. Britton, M.D., International Harvester Company.

Abstract:

EVERY doctor who is interested in and particularly those doing industrial medicine knows the value of early diagnosis of diseases that may or may not be directly associated with the employment of the individual concerned. Early recognition of tuberculosis in industry is not, *per se*, the problem, for the good and sufficient reason that the employee may go or be sent to the doctor after full development of the disease yet be "early" recognized. Recognition of early tuberculosis is the topic under discussion, and to that end I will confine my remarks.

3. "Industrial Solvents," by William D. McNally, M.D., Department of Medicine, Rush Medical College.

Abstract:

SINCE the widespread use of solvents in degreasing operations, dry cleaning, extractions of drugs, and since the use of one of the solvents as a fire extinguisher, there has arisen a necessity for more information regarding the health hazards, and the simple methods for their detection. As with refrigerants, the fire hazard was given first consideration with little thought of the health hazard. All volatile chlorinated hydrocarbons are poisonous. The great danger in the use of solvents lies in their ability to dissolve fats and lipoids alike in the body, skin, and in the nervous system. Some of these solvents gain access to the body by skin absorption, others by inhalation. Absorption by inhalation is the more dangerous as it comes in intimate contact with the blood and is carried to all parts of the body. The solvents may also have an irritating effect on the respiratory tract, laying one open to attacks of bronchitis and pneumonia. Some of the solvents may act very rapidly while with others the effect is retarded. The symptoms of poisoning by vapor exposure may be acute or chronic, depending upon the nature of the solvent, the concentraiton in the air, and the length of time of exposure. The plant foreman is exposed to the solvent for short periods only, while his workman is continually exposed to the solvent, therefore, the former shows no effect, while the latter, after some time, may show signs of chronic intxoication, such as loss of weight, gastro-intestinal disturbances such as anorexia, constipation, occasional diarrhea, dizziness, irritability, asthenia, and loss of muscular coordination. The symptoms of chronic intoxication may be due to damage of the central nervous system, of the liver, and of the blood-forming organs.

Unnecessary exposure of the skin to any fat solvent, should be guarded against. Exposed arms and hands should never be immersed in a solvent. In the degreasing of small parts, mechanical means should be employed. When the operation involves larger quantities of material to be degreased, exposure to the vapor may be lessened by closed systems. Consideration should be given to the selection of an appropriate solvent low in toxicity, and to the control of the concentration of the vapor in the air inhaled by the workmen. The fire hazard of each solvent must be considered along with the health hazard. Many of the solvents have been thoroughly studied, so that we now find proper safeguards employed. Because of the rapid development of new solvents, it is imperative that they be studied thoroughly as to the fire hazard, and the health hazard, before being given to the industry. Each plant physician should keep well informed about vapors and gases to which the workman is exposed, and he should cooperate with the safety engineer in reducing the health hazards to a minimum.

4. "Skin Affections in Industry, with Special Reference to the Value of the Patch Test," by Cleveland J. White, M.D., Chicago.

Abstract:

INDUSTRIAL dematoses constitute roughly about 60% of industrial diseases, not including actual accidents. The dermatoses are largely made up of dermatitis venenata and eczematoid dermatitides. The causative agents in the production of dermatoses in the normal skin are usually contactants; these will be reviewed in detail and the diagnostic patch tests will be properly evaluated. In eczematoid lesions the possibility of a preceding infectious agent, like ringworm, has to be considered and consequently the lesions produced by superficial fungus infections will be described. More and more non-eczematoid lesions are being observed, a specific example being the production of acneform eruptions by oils and certain types of insulation. As irritants are the most common cause of industrial dermatoses, a comprehensive review of all the

pertinent literature in the last five years will also be presented, whether the irritant be mechanical, vegetable, chemical or infectious—as bacterial and fungus.

AFTERNOON SESSION:

In conjunction with the Surgical Section of the Illinois State Medical Society:

1. "Traumatic Lesions of the Spleen," by CHESTER C. GUY, M.D., Chicago.

Abstract:

FREQUENCY of ruptured spleen, penetrating wounds, crushing injuries, injuries to associated viscera; analysis of cases at the Cook County Hospital; mortality; secondary hemorrhage; cases personally observed; review of literature; diagnostic criteria; treatment.

2. "Injuries of the Right Upper Abdominal Quadrant," by PHILIP H. KREUSCHER, M.D., Chicago.

Abstract:

INJURIES to the abdominal wall are discussed and include such lesions as hematomata rupture of the muscles and fascia as well as traumatic hernia. Trauma to the liver, with or without rupture, are taken up with a report of several cases, discussing symptoms and diagnostic features of this type of injury. Post-traumatic ruptures of ulcers of the stomach or intestines are covered. Injuries to the large or small bowel from direct violence are cited. Direct and indirect violence injuring the kidney are discussed in detail.

Section on Railway Surgery

THE SECTION ON RAILWAY SURGERY, of the Southern Medical Association will hold its Annual Meeting in Oklahoma City, Oklahoma, November 15-18, 1938. DR. GRORGE A. TRAYLOR, of Augusta, Georgia, is Chairman of the Section; DR. OLIVER B. ZEINERT, of St. Louis, Missouri, is Vice-Chairman; and DR. JAMES W. DAVIS, of Statesville, North Carolina, is Secretary. The program of this meeting, subject to certain additions, is as follows:

1. "Chairman's Address," by DR. GEORGE A. TRAYLOR, Augusta, Georgia.
2. "The Treatment of Fractures of the Hip," by DRS. LAWSON THORNTON and CALVIN SANDISON, Atlanta, Georgia.
3. "Abdominal Distention and Intestinal Obstruction Following Skeletal Injuries," by DR. THOMAS G. ORR, University of Kansas, Kansas City, Kansas.
4. "Railroad Surgeons, as I Know Them in the Communities They Serve," by MR. JAMES J. DONOHUE, General Claims Attorney, Louisville & Nashville Railroad, Louisville, Kentucky.
5. "Hand Injuries," by DR. H. H. THATCHER, Stevens Building, Portland, Oregon.
6. "The Diagnosis and Treatment of Mastoid," by DR. B. C. DYER, Atchison, Topeka & Santa Fe Railway, Topeka, Kansas.
7. "Head Injuries," by DR. A. W. ADSON, Mayo Clinic, Rochester, Minnesota.
8. "Improved X-Ray Technique in Studying Knee Joints," by DR. E. C. HOLMBLAD, 28 East Jackson Boulevard, Chicago.

The profession is invited; the meeting, as the program indicates, will be of profound interest to *all* physicians and surgeons, as well as those engaged in railroad work.

Chicago Medical Society

Enroute to the
AMERICAN MEDICAL ASSOCIATION CONVENTION
San Francisco, California, June 13-17

"MAKE arrangements to join our group and enjoy the privilege of traveling with your professional friends enroute."

For the comfort and convenience of members of the Chicago Medical Society, their families and friends, special arrangements have been completed with the Milwaukee Road, and the Union Pacific and Southern Pacific Railways for the operation of a DeLuxe "CHICAGO MEDICAL SOCIETY SPECIAL" train, to leave Chicago from the New Union Station, Canal and Adams Streets, at 9:00 P.M. Thursday, June 9, arriving San Francisco at 8:30 A.M., Sunday, June 12.

The "Chicago Medical Society Special" will be composed of the most modern type Pullman air-conditioned standard sleeping cars with lowers, uppers, compartments, drawing rooms, single and double bedrooms, club-lounge and observation car features, and all the refinements associated with a deluxe type special, including diner serving choice foods appetizingly prepared at moderate prices.

The train will be operated on a fast schedule, and no excess fare will be involved, regular rates applying throughout. Sleeping car rates for accommodations from Chicago to San Francisco, will be as follows:

Lower berth, $15.75; upper, $12.60; compartment, $44.50; drawing room, $56.00; single bedroom, $28.35 and double bedroom, $31.50.

The departure of the special from Chicago is timed to leave *after the close* of the meetings of the American Association of Industrial Physicians and Surgeons on June 9.

The trip to San Francisco, the Convention City, offers a splendid opportunity to combine the same with an extended vacation tour. California and the wide open spaces of the great west offer unlimited possibilities for enjoyable and beneficial recreation and sight seeing.

An itinerary in which interesting variations of return routes are briefly outlined is in the printer's hands; a copy will be mailed on request.

Reservations on the "Special" will be gladly accepted at any time and will receive the most careful attention, and if there is any particular return schedule desired, to be prepared covering other routes and stopover points, inquiry should be addressed to:

DR. GEORGE W. POST, *President.*
DR. ROBERT H. HAYES, *President-Elect.*
DR. FRANK F. MAPLE, *Secretary.*
DR. FRANK P. HAMMOND, *Chairman.*
DR. HOMER K. NICOLL, *Transportation Committee.*

Industrial Medicine

Reg. U. S. Pat. Off.

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VOLUME 7 APRIL, 1938 NUMBER 4

Progress in Education

EDUCATION in industrial medicine 15, or even 10, years ago was mostly a matter of learning by experience. As with every kind of endeavor during the formative period, the principles which could be taught were gradually evolved from the practices which had to be learned. The field was young, and the method of trial and error was necessary.

Slowly, then, and with the steady inevitability that is characteristic of things destined to be permanent, certain fundamentals began to appear. These had basic qualities, and, as their number increased, they took on form and order—grew, as it were, into the skeleton outline of a new profession. And soon the pioneers who had been associated with their development began to be articulate concerning them. And, naturally, their expressions centered around the avoidance of further trial and error in all respects of the matters and principles which had been established, so that the filling out of the skeleton into the full body of the science might not be delayed by unnecessary attention to proving again what had already been proved.

That is the evolution of all education. And the next step is the teaching of what is known.

Ten years ago, therefore, the leaders in the forward movement of industrial medicine were looking forward to the *time* of the teaching. They foresaw its coming, and went to work on its form. Thus, from an article by DR. SAPPINGTON, which was published 10 years ago this month:

"One must go back to the student in the medical school. Curriculums should be so constructed and arranged that the medical student will be exposed to the fundamentals of industrial medicine. Not only must the undergraduate be provided for, but the postgraduate courses should be so correlated and so organized that greater opportunity will be presented for the promulgation of basic fundamentals on industrial hygiene among established practitioners."

The outlook then seemed mostly that something should be done, that teaching, as it was going on with other sciences, should begin with this one.

Five years ago, however, midway between then and now, the expressions seemed to be taking it for granted that teaching was being done, but that *more* of it should be undertaken. Thus, from another of DR. SAPPINGTON'S articles:

"*Greater opportunity* for the study of industrial environment and clinical material must be afforded not only to medical students, so that we may be bringing on 'new blood,' but also for the continued enlightenment of existing practitioners and further for the use of postgraduate demonstrations and teaching." (Italics ours.)

And *now* the opportunity is "greater," as the outlines submitted by DR. HAZLETT (page 194) and DR. SINK (page 196) conclusively demonstrate.

EDUCATION in industrial medicine, therefore, has form and substance — in the fact alone that such courses are available. And industrial medicine has the full body of an adult status among professions—in the fact alone that the mere outlines of the courses are such as they are.

DR. HAZLETT says of the course with which he has been associated since its inception: "Unquestionably in the near future additional hours will be given to it." This course is in the Medical School. So far as we know it represents the first attempt to include a definite course of industrial hygiene in the curriculum of any medical school in this country, particularly as a separate entity. The significance, however, lies in the fact that it *is* now included. Education in industrial medicine *has* progressed, and will continue so to do.

DR. SINK'S program is the result of an intensive interest in the subject he has been teaching for the last 10 years at the University of Michigan. His outline is conclusive of the truth that industrial hygiene is a matter of major importance in the economics of the civilization which, so far as history speaks, has more advantages than any that preceded it. And it is eloquent of the additional truth that there are more things in it to know and be familiar with than most people would consider possible.

Occupational Diseases and Industrial Surgery

Occupational Diseases and Their Relative Importance to Medical Practice

ROBERT T. LEGGE, M.D.,
Professor of Hygiene, University of California

ONE is impressed by the limited knowledge and the lesser known facts about the common occupational diseases which are the results of physical and chemical agents.* The tremendous advancement in knowledge of physical and synthetic chemistry during the last 20 years has developed useful discoveries which have brought about social and industrial changes almost revolutionary, and have produced a train of industrial and domestic hazards of corresponding significance. Every new process, improvement, or discovery presents some new danger—so much so, that today occupational hazards exist in from four out of five trades. To complicate matters, composite industrial toxic chemicals may have variable effects on the worker. Two substances may mix to yield a new chemical body, they may modify each other, the penetrability of the cell membranes may be affected or made less absorptive. Because of the increasing number of chemicals being used in industry and in the home and farm and also the increased morbidity due to toxic substances which often are factors in the cause of chronic degenerative diseases not properly diagnosed, it behooves both the industrial physician and the general medical profession to be continually observant in order that they may be equipped for a better understanding of occupational diseases, of toxicology, and of the physiological and pathological changes encountered.

In the field of public health, and for that matter in the general practice of curative medicine, consideration of the chief causative agent of disease has been centered on bacterial origin. It has been from this basis that modern medicine and public health have developed.

When you consider this great industrial country of ours, in which practically 50 million workers are gainfully engaged, it becomes clear that medical and public health professions must take more interest in occupational diseases. One has only to consult a general textbook on medicine to find that it contains descriptions of not more than about 10 occupational diseases.

At the Midwest Conference on Occupational Diseases held at Detroit, in May, 1937, E. R. Hayhurst defined an industrial hazard as any condition or manner of work which is beyond the threshold of physiological adjustment of the human being so engaged. An occupational disease he defined as any affliction which is the result of exposure to an industrial hazard.

Industrial hazards he grouped under 10 convenient headings which are enumerated with typical examples of occupational diseases, as follows:

1. Poisons: Lead, carbon monoxide, etc.
2. Mechanical Irritants: Mineral and metallic dusts, silicosis, cement itch.
3. Friction and Pressure: Housemaid's knee, callosities on fingers.
4. Fatigue: Eyestrain, neurosis, tenosynovitis.
5. Infections: Anthrax, glanders.
6. Diseases following accidental injury: Deformities, secondary infections.
7. Abnormal spectral conditions: X-ray exposure, nystagmus.
8. Extreme temperatures: Heat stroke, glass blowers' cataract.
9. Noise: Boilermakers' deafness.
10. Abnormal atmospheric pressure: Caisson disease, rarefaction disease of aviators.

Some occupational diseases are definitely specific or characteristic, as silicosis or tar cancer. Others may be partly occupational affections, where the hazards may exist elsewhere than in connection with the work — for instance bad living conditions, pathological state, or faulty hygiene, resulting in tuberculosis.

Occupational health complaints which are pre-disease symptoms, such as headaches, insomnia, numbness, etc., are not true diseases; nevertheless they are the early manifestations of definite industrial health hazards, worthy of medical differentiation. Then there are conditions which are neither diseases nor complaints, but which may be advanced by one's occupation, such as postural defects and flat feet.

The physician should be guided by these facts in considering the possible health hazards in industry and should investigate pre-disease symptoms for the purpose of determining whether they are related to a characteristic occupational disease. He should also be able to definitely differentiate between compensable and non-compensable occupational illnesses.

At the end of the seventeenth century, the immortal Ramazzini, father of industrial medicine, was first to realize the importance of the causative connection in occupation and disease. It was his practice to ask every patient, "What is your occupation?" He states that the medical man, even when aware of the patient's profession, seldom accredits sufficient importance to it. To illustrate a case: A man ill for three weeks with jaundice, claimed he had been prospecting for the past month. After 10 days in a hospital where he was thoroughly examined and given every available test, the cause of his jaundice was unknown. He was obliged to leave the hospital for financial reasons, to go home and to close out his business. It was then learned that he was a dry cleaner; immediately the diagnosis of carbon tetrachloride poisoning was clear.

In the general practice of medicine, we physicians must not be misled into believing that the toxic hazards which are responsible for many of the occupational diseases are primarily confined to industry. The chemical age has ventured into warfare, into agriculture, and into our own domestic lives. The present-day practitioner should bear in mind that the definite cause of much disease is some toxic chemical. We cannot help observing the ever-increasing morbidity and mortality rates in our homes, due too often to modern physical and chemical agents such as carbon monoxide gas from heating appartus and exhausts from automobiles; solvents, polishes and cleaning compounds; the paints, insecticides, disinfectants; electric shock, etc.—the same deadly agents which are daily encountered in industry. More and more is the physician obliged to know the effect that these toxic agents have on the incidence of morbidity. Take for instance a paint remover containing benzol, so popular today for removing old paint in preparation for beautifying kitchen and bathroom furniture. A housewife using such a product may develop a type of weakness like that which follows influenza but without any cough or other signs—a puzzling case. A routine blood count, if made, discloses a low leucopenia. A diagnosis of agranulocytosis is made, and the real agent, benzol, often is not suspected.

It is high time for the medical profession to think in terms of occupational disease etiology in considering every obscure case not due to an infectious process. It is also time for the profession to be able to interpret the nature of phenomena in the worker who possesses a history of contact with any chemical hazard, especially since these cases are now found in the home and on the farm as often as in industry. In the general practice of medicine in our rural communities, especially in the horticultural districts, conditions similar to those of industry are encountered

—*Continued on page 219.*

* Read before the Utah State Medical Association, Salt Lake City, Sept. 2-4, 1937; published in *Rocky Mountain Medical Journal*, March, 1938.

THE AMERICAN ASSOCIATION

of

INDUSTRIAL PHYSICIANS and SURGEONS

Component Societies

Central States Society of Industrial Medicine & Surgery

Association for the Advancement of Industrial Medicine & Surgery

THE object of this Association shall be to foster the study and discussion of the problems peculiar to the practice of industrial medicine and surgery; to develop methods adapted to the conservation of health among workers in the industries; to promote a more general understanding of the purposes and results of the medical care of employees, and to unite into one organization members of the medical profession specializing in industrial medicine and surgery for the mutual advancement in the practice of their profession.

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ANNUAL MEETING

THE 1938 Annual Meeting of the American Association of Industrial Physicians and Surgeons, and the 1938 Midwest Conference on Occupational Diseases, will be held at the Palmer House, Chicago, June 6, 7, 8 and 9, 1938.

Proposed Amendments

IT IS proposed to amend the Constitution and By-Laws of the American Association of Industrial Physicians and Surgeons as follows:

Article III. Sec. 1: Membership:

Membership in this Association shall be of four classes:

(a) Active: Only physicians who are actively engaged in the practice of Industrial Medicine and Surgery or who are engaged in the investigation of industrial medical problems shall be eligible to active membership.

(b) Associate: Other physicians and individuals who are not physicians but whose work or activities bring them within the realm or province of the industrial physician, shall be eligible to associate membership.

(c) Honorary: Any person who has contributed distinguished service to the objects for which the Association stands shall be eligible to honorary membership.

(d) Fellowship: Active members of the Association and of its component societies, after two years of membership in the Association or their respective societies, may apply for Fellowship. Fellowship will be conferred by the Board of Directors upon applicants who have been actively engaged in the practice of Industrial Medicine for at least five years and shall successfully pass an examination to determine that they are fully qualified to practice Industrial Medicine and Surgery.

A suitable certificate, attesting that they are "qualified in the Art and Science of Industrial Medicine", will be issued by the officers to those upon whom Fellowship has been conferred.

Amend the By-Laws as follows:

Article II. Sec. 1: Dues:

In line two, after 'per year', add: "except where a special arrangement is made with an organized group to come in as a body".

Article V. Committees: Add Sec. 4:

The President shall appoint an Examining Committee to pass upon the qualifications of applicants for Fellowship.

A further amendment is offered, to change the beginning of the fiscal year of the Association from January 1 to July 1, of each year.

These proposals will be presented, for appropriate action, at the Twenty-Third Annual Meeting, in June, 1938.

—Continued from page 217.

and many perplexing problems confront the physicians. For instance, the toxic agents that are used as disinfectants and insecticides for spraying trees and garden plants must be discovered and considered. Our Agricultural Experiment Stations, in the endeavor to destroy scales, insects, worms, et al., are continually developing the use of newer rare elements as thallium and selenium. These researches are of interest to general medical practitioners, for they reveal important causative factors as well as impressing one with the wonders and dangers of chemistry. Selenium, for example, is a successful spray in the destruction of the red spider, yet it is most dangerous to cover crops of certain forage and table plants which take this element from the soil, for death to animals and morbidity to man may result.

According to a recent report compiled by the Ohio State Board of Health, Bureau of Occupational Diseases, it was found that among the compensable cases, 64% were cases of dermatitis. Dr. Swartz, of the U. S. Public Health Service, estimates that of the 25 million workers, 1% or 250,000 cases of occupational dermatoses occur annually, the costs of which amount to $4,000,000. The chief causes of dermatitis were from chemicals of various types used in certain processes, e.g., cutting oils and greases, paints, dusts and abrasives.

All cases of eczematous and pustular skin lesions found among industrial workers should be carefully investigated to determine the causative agents and a clinical history should be recorded, not only for the purpose of treatment but for prophylaxis. The same consideration should be observed in regard to the housewife who in the course of household routine comes into contact with various cleaning compounds, dyes, solvents, washing powders, insecticides, etc.

EVERY physician in studying the etiology of the various occupational skin diseases should also consider the possible role allergy plays and should make the patch test part of the routine examinations. Many of these cases may prove to be from other than industrial sources. It is well known that many irritants are due solely to particular processes, as is the case with lacquer workers and persons suffering from acne from handling synthetic wax prepared from chlorine and napthalene.

The general practitioners owe to their patients and to the medical profession a specific duty—that of making a searching inquiry as to the causative agents in all cases of dermatological manifestations, and especially to epitheliomatous growths. Again the first question is presented: What is your occupation? What chemicals and irritants are used in the processes? Then the search for the known substances that possess carcinogenic properties is in order.

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Industrial cancer of chimney sweeps has been known, since Potts' day, to be caused by soot. It is also found as an occupational disease among mule spinners affecting the scrotum resulting from the use of lubricating oil. Among aniline workers the dyes cause papillomatous growths in the bladder. Tar cancer is found in pitch and asphalt workers and lung cancer among miners where cobalt arsenic dust elements are present.

WITH the introduction of new chemical elements and physical agents possessing unknown carcinogenic properties, the medical profession must be suspicious of many possible hazard factors in the increasing incidence of malignancy.

In industry at the present time, the greatest hazard attracting our attention is the increased use of solvents and the halogen derivatives of hydrocarbons of low specific gravity which are definitely toxic. The collective knowledge we have at present, as to how these poisonous agents act upon certain cells when inspired, the pathological changes that take place in different organs and the signs and symptoms that are significant in comprehending and making a diagnosis, is far from conclusive. It should be an axiom, as Zangger of Zurich pointed out, that all solvents are toxic, depending upon amount of exposure and concentration. Some volatile solvents have an effect on some special organs such as turpentine, producing nephritis; carbon bisulphide, sterility; methyl alcohol, blindness; benzol, menorrhagia; and carbon tetrachloride, toxic jaundice.

Physicians must recognize that jaundice cases are very likely to be due to toxic solvents, metals or gases, such as benzol, carbon tetrachloride, chloroform, arsenic, phosphorus, etc. In practice we are already familiar with toxic jaundice and acute yellow atrophy of the liver following administrations of salvarsan, and with the use of chloroform anesthesia in obstetrics.

While it is true that available industrial mortality statistics indicate that the deaths caused by occupational diseases seem insignificant compared with those resulting from accidents, viz., one to 45, still it is well known that the mortality rates among industrial workers are greatly in excess of those in the higher economic classes. The unskilled group of workers show the highest rates.

Certain diseases, such as tuberculosis or pneumonia, may be partly occupational in nature. An industrial hazard in the form of an irritant, fume, or dust may aggravate or reactivate a process in the pulmonary structures.

It is definitely estimated that some 15 million persons in the United States are employed in the manufacturing, chemical, and mineral industries. Among the general illnesses afflicting these workers, tuberculosis,

pneumonia, and degenerative diseases are preponderant. About a half million alone are exposed in the dusty trades in which silica is a definite hazard and the tuberculous incidence high.

In the mining fields in the state of Utah there are two important occupational diseases, plumbism, which is due to lead ore reduction, and silicosis. Both can be controlled by medical and engineering supervision.

Among lead workers the program for medical supervision is to provide periodical examinations, to note early outstanding symptoms, such as loss of appetite and weight, anemia, and consequent pallor, headache, and tremors of hands and eyelids which are found in 90 to 100% of those exposed to this metal. Blood examination will reveal an increase of the basophilic stippled cells, 1½% and over being conclusive evidence. A chemical examination of the urine will show evidence of lead ingestion, and the classical lead line of the gums may be present. The engineering procedure for the prevention of lead poisoning involves the making of atmospheric tests for lead contamination, and mechanical ventilation and wet processes and respirators.

SILICOSIS likewise is controlled by medical and engineering methods. A careful medical chest examination with x-rays must be made of all applicants who are to work in a dusty atmosphere containing SiO_2 as quartz, sand and granite. It is of essential importance to obtain exact information regarding an applicant's previous occupation and length of time employed. A recorded history is important, as a worker may have previously worked in a high percentage silicon dust atmosphere, and even though he had been removed from the irritating influence for a long period, the progress of the disease would continue. The three stages of the disease are well known clinically, depending upon the amount and time of exposure to atmospheres containing silicon dust, terminating in chronic pulmonary fibrosis superimposed tuberculosis. In the Rand the estimated time before this advanced stage occurs is about 10 years. The engineering control consists first in determining the physical and chemical content of the dust particles inhaled. The dangerous ones measure from .5 to 10 microns. The density and concentration of the dusty atmosphere can be measured by instruments. The dust from drilling and blasting can be markedly controlled by protective devices, wet processes, dust traps and powerful mechanical exhausts. Each one of these two foremost industrial diseases would alone require a large volume to cover them fully.

As the incidence of tuberculosis decreased the general mortality rates during the last 30 years, the industrial tuberculosis mortality curve rose and continued high. The conquest of tuberculosis in industry will be

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possible when occupational tuberculosis becomes a reportable compensable disease, and when industrial medical practice becomes more perfected.

Outstanding occupational diseases such as lead, silicosis, and carbon monoxide have been scientifically studied, the various signs perfected, accurate simple tests for their detection made and measure for the prevention and therapy based on sound physiological research formed. The future will likewise develop the same definite knowledge of many of the industrial diseases which at present are not completely understood. Furthermore, medical science and industrial hygiene will insist that chemistry through research must outlaw many toxic agents now in use and bring forth substitutes more hygienic for mankind.

The pathological manipulations due to radium, radioactive substances and x-rays, with the resulting incapacity among scientists and medical men, continue to present a serious occupational hazard. At the University of California radiation laboratory recently, in the researches in "splitting the atom," the resulting neutrons were found to be radioactive and from five to 10 times more lethal than x-ray. The decreased leucocyte count examination revealed definite changes to the organism.

EVERY industrial hygienist will welcome the day when all the states enact laws for occupational disease disability. The motive of such a law is not primarily for compensaiton, but, more important, for the securing of exact information as to the cause and effect of industrial diseases. Such information will insure experts in analyzing and integrating the physical effects on the worker, in establishing criteria as to minimum environmental exposure and in promoting control and preventive measures.

Our county medical societies from time to time should hold symposiums on the common occupational diseases and hazards, with demonstrations of simple tests for the prevention and identification of the causative factors and of the newer methods for treatments developed by our research laboratories and our industrial physicians.

Standards of medical education in American schools likewise have progressed during this last quarter of the century. They developed medical men, better trained in the basic sciences, who, when they enter these fields of industrial medicine or hygiene, possess a keener insight for the pursuit of investigation. It remains to be seen what the next decade will produce in view of the tremendous interest that the medical profession is now taking in these diseases. Undoubtedly many of the problems presented by the now unknown or unrecognized elements will be recognized and solved. These will suggest better methods for the pre-

vention of hazards by safety measures and will make possible the recognition of early symptoms before grave pathology develops.

Every commonwealth in the Union should have in the State Department of Health, a Bureau of Industrial Hygiene, with well trained personnel for laboratory and field investigations. Such a bureau will aid the industrialist and the general medical profession in promoting the recognition of the causes of disease due to physical and chemical agents. It should also conduct research in industrial toxicology, evolve standards in problems in engineering and in hygienic control and prophylaxis. Our knowledge and research would be materially advanced if all persons dying from occupational diseases could be autopsied for medicolegal purposes, compensating benefits, and especially for the better understanding of pathological changes involved. Such a procedure is made possible through the splendid progress in the present knowledge of silicosis and industrial tuberculosis at the Medical Institute at the Rand in South Africa.

The duty of the physician is to study and to itemize every possible plant hazard that may be harmful, or that may produce discomfort to the workers. This will include all the toxic substances that are used in the various processes and the physical agents that are contacted. The factory physician in endeavoring to improve the comfort and health of the employees so as to receive the maximum efficiency returns, must endeavor to improve his physiological understanding of man. If, as actuaries inform us, the span of life is less and the incidence of organic degenerative diseases higher in the industrially employed, there is a big task ahead for the medical and engineering profession, to determine by practical research the minimum working conditions necessary for the employee to perform his job within his normal capacity. In addition to the accidents and occupational diseases to be considered are the environmental conditions such as fatigue, strain, noise, monotony, jarring, illumination, ventilation, etc., all warranting scientific consideration.

Conclusion

THE contributions in this paper have been made in order to stimulate the interest of the general practitioner in medicine, in a plan for the furtherance of the discovery, diagnosis and treatment of all occupational diseases, including some of the same types of maladies that are found in the modern home and farm; to promote safety measures for the prevention of same; to develop and perfect simple tests for their diagnosis and detection; to encourage the establishment of a State Laboratory of Occupational Hygiene in each commonwealth; to insist on the reporting of occupational diseases, and to legalize autopsies on persons dying from them.

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Preliminary Report on Statewide Survey of Dust Hazard in Foundry Industry

APPROXIMATELY 2.7% of the 12,000 foundry workers in New York State are affected with silicosis, and of this number about 0.7% show signs of tubercular complications, State Industrial Commissioner Elmer F. Andrews and Dr. Leonard Greenburg, Executive Director, Division of Industrial Hygiene, revealed in a preliminary report on the most searching study of this industry ever attempted by any agency.*

Mr. Andrews expressed the opinion that while the silicosis hazard in the foundry industry in this State is existent, it is of a mild degree of severity and may be expected to yield satisfactorily to appropriate measures of control. He pointed out that the incidence of the disease as disclosed by the study is much less frequent than many previous surveys have indicated. He stressed the fact that the foundry industry was selected for investigation not only because its workers are exposed to silica dust, the cause of silicosis, but also because it has the largest number of persons in any single trade exposed to this dust.

Each of the 311 foundries in the State of New York was carefully inspected and of these, 80 were selected for special study. These foundries were carefully chosen with a view to getting a representative cross section of the industry as a whole in terms of the kind of materials cast—i.e., whether castings were made of iron, steel, non-ferrous materials or any combinations of these — the intensity of exposure to dust, size of foundry, geographical distribution and the like. Approximately 4,169 persons, one-third of all foundry workers in the State, were employed in these 80 foundries.

Of this number 4,066 workers were x-rayed, and a complete occupational history was taken in each case. The kind of work done in the foundry was noted, as well as the total duration of exposure to silica dust—either in the foundry in which the worker was being examined or in other foundries where he had worked previously. In the case of each worker, all of these findings were correlated with the condition found in his lungs as shown by the x-ray picture. Plants and workers were given code numbers and the results of individual examinations have been kept strictly confidential in accordance with an agreement made with the union.

According to the report, 110 cases of silicosis were discovered in the group of 4,066 persons examined. Of these, 88 or 2.2% were in the first stage; 16 or 0.4% were second stage; and 6 or 0.1% were third stage silicosis. Of the 110 cases 15 or 0.7% showed signs of tuberculosis.

The engineering investigation covering all of the 311 foundries in the State showed that 32 foundries or 9.7% of the total were in good condition so far as the silicosis hazard is concerned; 91 or 27.5% in fair condition; 150 or 45.5% in poor condition; and 57 or 17.3% in bad condition. Great variations were found in the character of the dust problem from one plant to another. The general conclusion was reached that proper plant operation—particularly good "housekeeping" — rather than additional mechanical equipment — would seem to be the most important factor in preventing silicosis in this industry.

General recommendations for foundry dust control, as included in the report, cover building construction and layout, "housekeeping" and rules for the various processes carried on in the industry.

The study which was conducted under the supervision of Dr. Greenburg inaugurates a series of similar studies in the various industries where silicosis hazards exist. The action was stimulated by the passage of an amendment to the Workmen's Compensation Act which made silicosis a compensable disease on and after September 1, 1935.

INTERESTING excerpts are:

"An inhalation of finely divided silica dust over a period of time may, and often does, produce certain characteristic changes in the lungs. These changes constitute the disease 'silicosis,' a condition which may be defined as a chronic disease of the lungs in which there is a marked increase of fibrous or scar tissue. This has a characteristic x-ray appearance and as the increasing fibrous tissue encroaches on the normal lung tissue there results shortness of breath, lessened capacity for work, and increased susceptibility to tuberculosis. In the advanced stages of the disease, particularly when tuberculosis is superimposed, there may be complete disability.

"There are wide variations in the data cited in previous studies of foundry workers as well as in the fundamental groundwork of the studies cited. For example, the actual number of men examined varies between wide limits from five to 4,000 men. Some groups include only one type of foundry, others all types, while in still other studies no mention is made of the type of foundry. The percentage of those showing fibrosis varies from slightly over 7% to 22%; of those with first stage silicosis from approximately 1% to 40%; of those with advanced silicosis from less than 1% to 32%; and of those with silicosis and tuberculosis one-fourth of one per cent to 32%. Active tuberculosis was found in 0.47% of men examined in one study and in 8% in another. This makes clear the absolute necessity of securing a true cross-sectional sample of exposed workers as was done in this study, if one is to evaluate truly the silicosis hazard in New York State.

IN ORDER that the study might be considered applicable to the industry as a whole, that is, in order that the group x-rayed might be a true sample, it was necessary that the group studied be sufficiently large. For this reason, it was decided to include at laest one-third of the total number of foundry workers in the State. In addition it was necessary for the group, insofar as possible, to represent plants of all sizes. Moreover, this same criterion should apply to the geographical location of the plants as well as to the type of metal being cast. After careful consideration of all these factors, 80 plants were selected.

"The field party engaged on the x-ray studies consisted of four persons. Two were x-ray technicians and two investigators. The group transported the x-ray machine from plant to plant, set it up ready for use, and then while two of the group took occupational histories, the other two took the x-ray pictures.

"Most of the foundry workers, 1,950 or 48.3% of the total were employed in iron foundries, and the next largest number in foundries where casting of more than one type of metal was carried on. There were 347 or 8.5% working with nonferrous metal, 360 or 8.8% working with steel, and 1,399 or 34.4% working with combinations of metal.

"This study discloses the largest percentage of foundry workers to be between 40 and 45 years of age. The obvious conclusion is that foundry work is not done by young men but rather has a predominance of workers in the older age groups.

"It is obvious that many men were employed in their present foundry for relatively shorter peroids of time than was their total employment in the foundry industry. It will be seen, for example, that 10.3% of foundry workers had a total foundry experience of less than two years, whereas a large number, 17.4% or 704 men had been employed in their present foundry less than two years. In other words, 285 men had previous employment in other foundries than the one in which they were found at the time of the study. These 285 workers had other dust exposure which may, and probably did, have some contributory effect to their present pulmonary status.

"The differentiation of cases of silicosis in the first, second or third stages is more or less arbitrary but is useful as an indication of the extent to which the condition has advanced. In the first stage there is a

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* *Industrial Bulletin*, February, 1938.

generalized fibrosis in which definite small nodules are apparent. In the second stage there is generalized medium-sized nodular mottling throughout both lung fields in which the nodules are, for the most part, discreet, but may also be found here and there in localized aggregations. In the third stage the nodular mottling is more intense, the nodules are larger and take on a conglomerate form so that large shadows are shown corresponding to areas of dense fibrosis.

"The average incidence of fibrosis of the lungs among foundry workers was found to be 4.5%. A moderate degree of pulmonary fibrosis of a linear type is not uncommon among city dwellers and among many types of industrial workers. An average rate of 1% to 2% may reasonably be expected among male industrial workers in the age groups of those examined in the present study.

An increase in fibrosis may be expected wherever there is a marked dust exposure.

'The specific rate of fibrosis for men employed less than two years in the foundry industry is 0.2%, and there is a continuous increase to 15.5% for men employed between 35 to 39 years. The rate for 40 years or more falls off slightly to 11.5%.

"The fibrous rate for iron foundries and foundries casting metal of various types was found to be practically identical, 4.7%, as compared with 4.6%. The non-ferrous showed the lowest rate, 2.2%, and those foundries making steel castings showed the highest rate, 5.5%.

"Among specific occupations, though, the numbers are too small to be of great significance; more silicosis occurred among chippers, than in the other foundry occupations.

AGE of itself, apart from exposure is not particularly significant in studying the incidence of silicosis. One case occurred in the group less than 35 years of age. The largest proportion in any one age group, 30 cases or 26.3% was found among those in the age group 50 to 54 years; 60 cases or 54.6% occurred in men 50 years of age or more.

"The incidence rate of silicosis for foundry workers is lowest in the occupational exposure group two to four years (0.3%) and increases almost continuously to 9.0% for those employed 40 years or more.

"The specific rates for silicosis, stage one, by duration of foundry exposure, range from approximately 1% for those exposed from five to nine years to 7.4% for those exposed 40 years or more. For second stage silicosis the rate is between 0.1% and 1.4% while the specific incidence rates for third stage silicosis range from 0.2% to 0.8%.

"Plants employing less than 50 men have slightly higher rates for silicosis than the others. The difference is minor, however.

"Of the 80 plants in which examinations were made, 37 or 46% were entirely free from silicosis. There plants were, for the most part, small in size, 32 of them employing fewer than 50 workers each, 18 of them were iron foundries, 11 were non-ferrous foundries, and eight were foundries where metal of several types was cast. An explanation is really not required. With an overall silicosis rate of 2.7% by the laws of chance alone many of the foundries would escape having included among their small group of employees one of the workers who had silicosis.

"Contrary to what might have been anticipated, silicosis rates among the 180 colored foundry workers were lower than those for the group as a whole. There were only three cases of silicosis in this group; two in grinders and one in a chipper, making a rate of 1.7%."

The complete report on the foundry survey is now about ready for the printer and will be issued shortly as a Special Bulletin of the Department of Labor.

Some Pitfalls in the Diagnosis of Silicosis

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From the Department of Internal Medicine (Chest Service), St. Louis University, and from the Municipal Chest Clinics, St. Louis Health Division

A REVIEW of the rapidly accumulating literature on silicosis reveals numerous contradictions and misconceptions regarding certain phases of silicosis.* While the reader notes a general agreement existing among the writers as to etiology, pathology, symptomatology, and the ineffectiveness of treatment, he is at the same time aware that a confusion exists concerning the diagnosis of silicosis.

The purpose of this paper is to point out possible pitfalls into which the inexperienced physician can be lured in arriving at a diagnosis. These pitfalls can be avoided if all procedures, upon which the diagnosis of silicosis is based, are carefully analyzed and interpreted in relation to each other rather than evaluating them separately.

It is generally agreed that a diagnosis of silicosis should be based upon:

1. History.
   (a) Prolonged exposure to a dusty atmosphere containing a high concentration of silica, the individual particles of which being less than 10 microns in diameter.
   (b) Symptoms, such as dyspnea, dry cough, and pain in the chest.
   (c) Lack of toxemic symptoms.
2. Physical examination of the patient.
3. Fluoroscopic and roentgenographic examinations of the chest.
4. Macroscopic and microscopic examinations of the lungs.
5. Chemical examination of dried lung tissue for determining the amount of silica.

1. HISTORY: The occupational history of the patient should reveal the type of dust exposed to, the atmospheric concentration, the silica content of that dust, the size of the particles, and the length of exposure. In routine examinations in dusty industries this information is not impossible to obtain and when elicited is of definite aid in the diagnosis. However, in the office, dispensary, and hospital practice it is frequently impossible to acquire these facts since many of the victims know very little about the composition of the dust which they have inhaled. Difficulties either arise from the fact that many of the employees in the dusty industries are foreigners who are unable to speak the language, or that some employees give a history of having been exposed to more than one dust in more than one industry, or finally, that any attempt to obtain accurate information from industry through the patient alone or with the aid of social agencies nets negative results because of the fear on the part of industry of possible medicolegal complications. Obviously such an inadequate history of dust exposure loses its significance as an aid in the diagnosis of silicosis.

One must guard against many pitfalls in the evaluation of symptoms given by the patient. The tendency to exaggerate the complaints in medicolegal cases is well known to the experienced physician. In many instances the multiplicity and severity of complaints of the patient have their origin in the office of the ambulance chaser. Early silicosis does not produce disabling symptoms and for this reason patients with early disease are seldom seen in the hospital, dispensary, or physician's office.

Early silicosis is usually discovered in the course of routine examinations of employees in dusty industries and the diagnosis is generally based on the known history of exposure and on serial x-ray films. Manifestations of moderately advanced and advanced silicosis are such symptoms as increasing dyspnea, cough, and pain in the chest—complaints which cause the patient to seek medical advice. In these stages the physical findings are more pronounced, the exposure history quite definite and the roentgenograms usually reveal a bilateral nodular fibrosis which is quite often more pronounced on the right side. When a patient presents dyspnea as a prominent symptom

* In *Diseases of the Chest*, February, 1938.

and the physical and x-ray examinations fail to reveal pathology consistent with a silicosis despite a positive exposure history, one must search for possible bronchial asthma, emphysema, cardiac disease, bronchogenic carcinoma with obstruction, or any condition that will cause an obstruction of a bronchus leading either to an obstructive atelectasis or an obstructive emphysema. The writer has been baffled by so-called typical histories and symptoms only to find that the actual cause of the complaints was not silicosis, but one of the diseases just enumerated.

Hemoptysis is not a common complaint, but it does occur in some silicotics. It is generally believed that when this symptom manifests itself it is due to an associated tuberculosis. The accuracy of this belief must be questioned since it is not always confirmed by autopsy. In a previous communication the writer[1] has reported cases with hemoptysis in silicotics, yet autopsy material of the same patients studied bacteriologically and histologically failed to reveal evidence of tuberculosis or any other infectious process in the lungs.

2. PHYSICAL EXAMINATION: The writer believes that the physical examination as an aid in diagnosis has been underestimated probably because its value in the diagnosis of silicosis is still a controversial subject which is clothed with misconceptions. For instance, A. E. Russell[2] and co-workers state: "The diagnosis of silicosis by means of the x-ray alone is comparatively easy when the condition is fully established, while the physical examination is of more importance when the disease is in the incipiency because x-rays do not indicate early fibrosis as well as that which has existed longer and is of greater density." On the other hand, Edgar Mayer,[3] in a relatively recent paper states: "The physical examination helps little inasmuch as the abnormal findings are those peculiar not to silicosis, but to general pulmonary fibrosis with emphysema." From a review of the literature one is inclined to the belief that on the whole the greater emphasis is placed on the fact that the physical examination of the chest yields negative results. Some of the misconceptions lie in the contention that the simple silicotic chest is a dry chest and emphysematous in shape. Little emphasis is placed on the fact that the silicotic chest is one with bilateral limitation in expansion and is not necessarily barrel shaped. One often encounters third-stage silicotics with marked limitation in expansion of their chests showing negligible clinical evidence of emphysema. In the writer's experience, the silicotic chest more often presents evidence of bilateral diminution of expansion than any other physical sign. While this cardinal sign is not as a rule noticeable in early silicotics, it is quite definite in the later stages. Tactile fremitus is generally diminished or absent over the involved areas. Diminished resonance to definite dullness on percussion is first noticeable at the roots of the lungs. As the disease progresses the percussion note becomes increasingly duller from axillary region towards hilum, especially anteriorally. It is not uncommon to find a slight hyperresonance to percussion at the extreme apices and bases of the lungs except when the diaphragm is elevated by adhesions in the latter instance.

The outstanding asucultatory finding is a general softening or mild suppression of breath sounds over the involved areas. A prolongation of the expiratory note is frequently noted. At times the breath sounds may have a rough and harsh characteristic. Occasionally a few sibilant and sonorous notes may be heard usually in advanced cases. Persistent localized posttussive rales in axillary region and in first and second interspace have been heard by the writer for as long a period as five years in one patient with third stage simple silicosis in whom autopsy failed to reveal any evidence of tuberculosis.[1] Bronchial breathing is not infrequently heard in silicosis complicated by tuberculosis.

In summary it may be stated that the most constant physical findings in simple silicosis, in addition to the diminution of expansion of the chest, are dullness on percussion especially in the region of the middle two-thirds of both lungs and a softening and diminution of the breath sounds over the involved area.

FROM the viewpoint of differential diagnosis, it must be remembered that the physical findings are not by themselves pathognomonic of silicosis since lung abscess, cancer of the lung, thickened pleura, elevated diaphragm and atelectasis may present the same percussion and auscultatory findings. However, when a patient who complains of dyspnea presents, on physical examination of the chest, the essential physical findings as discussed above, silicosis should be suspected and inquiry should be made as to possible exposure to silica. The clinical impression should then be confirmed with a roentgenogram.

3. FLUOROSCOPY: The fluoroscope is of value in diagnosis of silicosis since it may reveal a diaphragm which is limited in motion, adherent, and tented. It may also reveal an increase in aeration at the bases because of compensatory emphysema and diminished expansion of the inner middle two-thirds of lungs because of the predominating fibrosis.

4. ROENTGENOGRAM: The roentgenogram in the later stages of the disease is almost diagnostic of the condition in many instances. In early silicosis, however, the roentgenographic findings are not at all pathognomonic since the same findings may be found in passive congestion of the lungs, bronchitis, asthma, fungus disease and bronchiectasis. Simple silicosis in the second or third stage may reveal a uniform characteristic bilateral nodular fibrosis, the nodules being rather discreet in size, appearing in the middle two-thirds of both lungs and diminishing in number toward the periphery. In this stage, miliary tuberculosis, bronchopneumonia and metastatic carcinoma must be ruled out. In the stages of conglomeration, consolidation and diffuse fibrosis in general, the x-ray picture is less typical since other lung diseases will simulate the condition. In silicosis with infection the roentgenogram becomes even more complex and one finds greater difficulty in diagnosing the disease on account of the masking of the silicotic process by the complicating pathology which may be tuberculosis, pneumonia, lung abscess or emphysema.

In long standing silicosis with marked pleural thickening the diagnosis is most difficult to make since the underlying pathology cannot be vizualized with the usual exposures, and special x-ray techniques are necessary to show the underlying silicotic process. The writer has seen such cases at the autopsy table where the true condition was first recognized.

It is obvious from the above discussion that even the roentgeongram which by itself is the greatest single aid in the diagnosis of silicosis is nevertheless by itself not diagnostic of silicosis.

5. LABORATORY: The various laboratory tests for silicosis such as sputum, blood and urine examinations are not of diagnostic value. The two postmortem specific diagnostic laboratory tests are of academic and medicolegal interest only. After the death of the patient, the macroscopic and microscopic examinations of the lungs will reveal the presence or absence of silicosis. The chemical examination of the dried lung will determine the amount of silica per gram of dried lung, the normal, according to McNally,[4] varying from 1.13 mg. to 2 mg.

The question that arises, namely, can silicosis be diagnosed in the early stage, can be answered in the affirmative, provided all facts are taken into consideration. The common practice of making a diagnosis merely on the roentgenogram alone or on the history of exposure to silica alone cannot be too strongly condemned.

In summary it may be stated that there is no pathognomonic symptom, sign or x-ray shadow in silicosis that cannot be simulated by other diseases. Therefore, all factors must be considered in making a diagnosis of silicosis. The committee appointed by the American Public Health Association for the purpose of studying the roentgenological appearances in silicosis and the underlying pathological lesions makes the following statement in its report:[5] "Only the

physician who has examined the subject, has obtained an occupational history of any adequate exposure to silica dust, and has before him a suitable roentgenogram of the chest, should make the diagnosis of silicosis. The roentgenologist not in possession of these facts, can merely state whether the shadows which he sees in a film are consistent with his diagnosis."

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Employee Examinations

CAPTAIN JOHN SMITH—object of Pocahontas' preventive attention—ran a glass bead factory.* The lye and sand used did unhealthy things to his workers. But so did the local Indians whenever no baubles were produced to pacify them.

So Captain Smith's artisans carried on, despite occupational ailments.

Today, by contrast, a healthy employee is prized as much as a peaceful Indian was three centuries ago in Jamestown. Hence the growing opportunity for private physicians to engage part-time in industrial medicine—specifically, in the giving of pre-employment and periodic physical examinations.

This opportunity is high-carat. Assay it for yourself:

Some 24,000,000 people are said to work for concerns too small to maintain medical departments. Yearly, on account of ill health, industry loses the services of its employees for a total of about 200,000,000 working days. This means an annual loss to American business of hundreds of millions of dollars. That this loss could be markedly decreased through additional emphasis on preventive medicine is an undeniable fact.

No less an authority than Dr. Carey P. McCord, medical director of the Industrial Health Conservancy Laboratories in Cincinnati, Ohio, has declared that industrial medicine could easily absorb 12,000 full and part-time physicians. This field can be still further increased if employers who do not now provide employee examinations were "sold" on the value of doing so. Employers should realize that sickness makes a far deeper dent in man-hours than injury does.

Still other evidence argues that many a business unit is either on or will get the scent of profit in employee-physicals.

The anti-syphilis campaign, though specific, accents the general value of medical check-ups. And it's country-wide.

Workmen's compensation laws are now found in practically every state in the union. These laws began years ago to prove that the most profitable employee is a healthy one. They still do.

At least one large state contemplates making pre-employment physicals compulsory. Other states, most likely, swept along on the present high tide of socio-economic reform, will follow the example.

Clearly, business is receptive to the profession's aid in maintaining employees' health. It has the sincerity of self interest. Statistics, laws, and practical demonstrations have proved that good management demands physically-fit personnel.

This selfish concern over employees' health is no longer confined to the manufacturing colossus. It has permeated banks, stores, hotels, and business organizations generally. In fact, almost every employer, regardless of the type or size of his business, has been conditioned at least to recognize the economy in a regular physical-examination program.

A convincing "Amen" to all this has been sounded by the American College of Surgeons. After its 1936 surveys of medical services in industry the college announced:

"Pre-employment and periodic health examinations . . . mixed with the proper follow-up and cooperation with private practitioners, offer one of the most suitable means for effecting preventive medicine that exist in this country today. More employers instituted physical examinations of their workers in the past year than in any year, with the exception of the period that immediately followed the enactment of workmen's compensation laws."

There, in brief, is the door to increased practice. How to open it?

Wholesale solicitation of such practice is obviously out of the question. But it is the right, if not the duty, of medical societies to urge local employers to retain reputable medical examiners.

Recall that a number of medical associations have campaigned successfully for vaccination, diphtheria immunization, and other preventive measures. Both physicians and the community have benefited. The objective was reached through newspaper publicity, placards, letters, and talks by doctors before interested groups.

The same media would serve for an employee-examinations drive.

Following is material which any medical society can adapt. A good public relations committee can whip it into a series of form letters to local employers, into letters to newspaper editors, into addresses before the Rotary, Lions, Kiwanis, or what have you. It is, in effect, a check-list of the advantages offered by pre-employment and periodic medical examinations of employees:

FOR EMPLOYERS

1. A healthy and, consequently, more efficient personnel.
2. Less labor turnover.
3. Reduction of absenteeism due to sickness.
4. Lightening of the sick-benefit load.
5. Improved employee morale.
6. Increased patronage due to advertising value to medical check-up program.
7. Elimination of accident-prone workers.
8. Delay in outlay for pensions.

FOR EMPLOYEES

1. Early detection of potentially disabling disease.
2. Reduction in medical expenses.
3. The confidence that comes from a clean bill of health.
4. Protection from communicable disease.
5. Less wages lost through sickness absenteeism.
6. Longer life expectancy.
7. Prolonged capacity to work efficiently.

The responsibility of making these points clear to local proprietors and wage-earners rests not only with one's medical society, of course. It belongs also to the individual physician.

Even though he can not ethically do much to solicit employee-examination work, he can, nevertheless, be on the alert when the subject is broached by local business men.

Because of his standing in the community, the physician has many opportunities to meet such men. And he can make others. At social or civic functions, through service club activities, he is constantly contacting employers. Sooner or later, they'll probably inquire about the advisability of employee-physicals in their offices, stores, or plants. When they do, the physician of their acquaintance who evidences a thorough knowledge of the subject will be in a preferred position.

Obviously, the more often a physician sees these men, the stronger his relationship with them and the greater his chances of being asked:

"Say, doctor, what do you think of medical check-ups for job-seekers and employees? Anything in it for me?"

Ethical instinct, common sense, and what you have just read should phrase a proper answer. And it may very likely result in some new practice.

* *Medical Economics*, March, 1938.

Industrial Group Illness

RECORDS indicate that disabling illness is 76% higher among unskilled labor, 40% higher among skilled labor, than in the so-called non-industrial group. The death rate among skilled labor is 24% higher, among semi-skilled labor 50% higher, among unskilled labor 116% higher than in the non-industrial group. Dr. A. D. Lazenby, chief surgeon for the Maryland Casualty Company and member of the Council on Industrial Health of the American Medical Association, commented on these figures and cited the work insurance companies are doing to raise the general level of industrial health. He declared that health problems of industrial life demand the best attention of the medical profession, and represent a field of activity in preventive medicine which has been neglected.

Reducing Lost Time from Accidents

Prompt Treatment of Injuries—Well Equipped Dispensaries

General Electric's Medical Department, West Lynn

MUCH has been done by safety organizations in recent years to stress the cause of industrial safety.* Once upon a time an accident was just an accident and taken as a matter of course.

The story is told of a certain worker in a railroad section gang some years ago named Casey. One day while driving a spike he missed his aim and the sledge hammer came down on his foot with crushing impact. In due course word of the accident got around to the railroad, and the foreman of the gang received a report to fill out in detail. All went well until he came to the last line of the report. The line was headed, "Remarks." He scratched his head, somewhat puzzled what to write, and then put down, "Do you want my remarks or Casey's?"

Whatever remarks Casey may have made on that occasion, it can be fairly well assumed they did not dwell too much on the subject of industrial safety. Rapid strides have been made not only in accident-prevention works by many of our largest industries since the first call of "Safety First!" but also in first aid treatments and prompt diagnosis of injuries. So efficiently are the medical departments of some of our larger manufacturing establishments managed that the number of man hours lost from accidents in the course of a year has been cut down to a mere fraction of their former figures. In the bargain much human suffering has been prevented and anxiety eliminated, due to wise company policies.

On these pages we call attention to a model Medical Department of the General Electric Company in West Lynn and show here how G-E employees are given prompt treatment in complete and well-equipped dispensaries.

Under the supervision of DR. THOMAS L. SHIPMAN, Works Physician at the Lynn General Electric plants, employees are given the benefit of the most modern methods for diagnosis and treatment. The equipment of the three dispensaries in the West Lynn works, the River Works, and in Everett is capable of meeting every ordinary emergency. It includes x-ray equipment, utensil sterilizers, facilities for physiotherapy, heat treatments, and the usual equipment necessary for routine physical examinations as well.

"The principal job of any industrial medical department," states DR. SHIPMAN, "is and always has been to care for employees who may be injured at work. Most of our work is on trivial accident cases; but the importance of fingers and eyes to the working man makes it necessary that these trivial injuries receive the best of care.

"We are extremely fortunate in the scarcity of infections. The majority of infection cases represent some measure of neglect on the part of the employee. In 1937, we cared for 6,746 new industrial cases. There were 11,331 redressings; in other words, nearly all of these accident cases were seen on three successive visits. Baking treatment and other forms of physiotherapy were used 4,389 times. In 1,391 cases, x-rays were taken. There were 1,752 orders for additional supplies for the first aid boxes. In all, we had 33,014 dispensary visits for one cause or another during all of the year 1937.

"The Works Medical Department is set up with headquarters at the River and a dispensary in both the West Lynn and Everett plants. The latter two are equipped to handle all routine cases, while special cases are sent to the River where a more complete line of equipment is available for treatment.

"Working in close cooperation with the Safety Department, the Medical Department is frequently able to discover conditions which may be changed to increase the convenience and safety on a job. It makes a careful check of the cause of accidents and works with the Safety Department to avoid having the same accident happen a second time.

"Cooperation with members of supervision is also an important part of the department's work, as it is only with their help that employees who have received minor injuries can be put back to work on special jobs until they are able to return to their regular work.

"If any accident case seems beyond our power, we immediately can have recourse to the facilities of the local or the Boston hospitals. We feel it unwise to attempt any medical or surgical problem which we can not do well.

"An important duty of the Medical Department is to oversee the various problems of a medical nature which arise in the works. In industry, it is necessary to use certain substances which are known to be poisonous if used improperly. It is the problem of the department to make sure that these substances are used in such a manner that there is no danger to the employee involved in their use.

"In this field we have the valuable assistance of the Division of Occupational Hygiene of the Massachusetts Department of Labor and Industries. With these men, we feel free to discuss our problems frankly, knowing that they will give us the best possible advice. We also come in close contact with the faculty of the Har-

TEN-YEAR RECORD OF LOST-TIME ACCIDENTS

SHOWING DECREASE THROUGH PREVENTION OF INFECTION, DETECTION OF HEALTH-DESTROYING OPERATIONS, AND INDUSTRIAL DISEASE

G. E. River Works Only	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937
Infections	13	43	23	12	3	4	3	5	2	8
Fractures	46	65	53	27	11	10	6	13	19	29
Amputations	15	8	7	4	1	1	2	4	2	3
Lacerations	51	60	23	22	10	11	11	8	17	20
Contusions	47	63	45	19	4	9	5	7	5	3
Eye cases	13	16	11	4	....	2	1	3	2	....
Sprain and strains	23	64	46	14	6	6	4	9	2	2
Fatal	2	1	....	1	....	....	....	....	....	....
Burns	13	17	5	4	4	3	1	2	2	1
Miscellaneous	1	....	....	....	1	1	7	2	....	1
	224	337	213	107	40	47	40	53	51	64
River Works & (Freq.)	12.91	18.58	15.08	10.95	7.79	8.57	6.08	7.93	5.97	5.09
Everett (Sev.)	2.073	1.073	.819	1.030	.43	.30	.266	.322	.167	.172

Frequency based on number of accidents per one million man hours.
Severity based on days lost per one thousand man hours.
This figure does not include a fatal accident occurring in the Everett Plant.

* From *Industry*, March, 1938, published by Associated Industries of Massachusetts.

A DAY IN THE LYNN WORKS DISPENSARIES

1. **X-Raying an old injury**
2. **Dr. Shipman at the microscope in his laboratory**
3. **Bandaging a second-degree burn**
4. **Nurse assisting Dr. Kaszett dressing an injured finger.**
5. **Baking the arm with a heat machine**
6. **Records of all injuries and treatments are made promptly**
7. **Dr. Shipman operating on a worker's hand to remove imbedded object**
8. **Bandaging a sprained ankle resulting from a fall**
9. **Dr. Shipman's secretary consulting record file**

vard School of Public Health. Their open-minded and scientific attitude is the spur which keeps our ideas from becoming stagnant, our methods from becoming antiquated."

Another duty of the Medical Department which is very important to the employees as well as to the Company is the routine physical examinations. The department's policy here is to assure both the employee and the Company that the former is physically suited to the requirements of the job and that he has no formerly unknown physical defects which might cause difficulty later if left unattended.

Speaking of this phase of the work, DR. SHIPMAN says, "Many men present themselves for employment unaware of the fact that they have poor eyesight. It is a revelation and a source of gratitude for these men to discover how much better they can see and how much better they can do their work when they are equipped with glasses.

"There are some jobs where it is advisable to carry out periodical physical examinations because of a known hazard in the work. These examinations form one means of increasing our store of knowledge about certain obscure conditions; they form a yardstick by which we know we are affording our employees adequate protection, or can take steps at once to do so."

Prevention of Industrial Dermatitis

THE word dermatitis really means an inflammation of the skin.* Since the skin covers practically the entire surface of the body it is certain to be subjected to the action of all the various articles of clothing, solution, chemicals, vapors and gases which with individuals come in contact in their daily life and their work.

Irritations or inflammations of the skin resulting from contact with such irritating substances are usually designated by the term "dermatitis." Not all cases of dermatitis are industrial in origin. In some instances the real cause of skin irritation is very difficult to determine.

In industry where there is such a wide variety of work to be performed it is only natural that the men and women who are employed are subjected to many hazards which are capable of producing skin irritation. Various solutions used for cleaning purposes containing soap, soap powders or strong alkalis quite often produce dermatitis of the hands and forearms. Such a condition often is seen among janitors, scrub women, dish washers, soda fountain clerks, dairy operators and others in similar work.

Another form of industrial dermatitis quite often encountered is due to the infectious organisms in various oils and cutting compounds used on machinery such as lathes, presses and tapping machines. Dermatitis produced by contaminated oil results in the formation of tiny pustules or oil boils which develop in the pores and hair follicles usually of the arms or wherever the oil is in frequent contact with the skin. The wearing of oil-soaked clothing quite often produces such a condition.

The use of various chemical solutions such as is necessary in plating departments often results in dermatitis unless proper precautions are taken to protect the skin. Nickel plating, chromium plating and the various solutions for cleaning materials to be plated require the use of this class of irritants.

Some of these chemicals produce a general irritation of the skin of the hands and forearms, while others may produce single ulcerated areas such as may occur from the use of chromic acid solutions. Occasionally the vapors arising from strong solutions are capable of producing an irritation of the skin or an ulceration of the mucous membrane lining of the nose.

Another common cause of industrial dermatitis is the action of various irritating dusts which come in contact with the skin. The irritation which results may be due to the caustic action of the dust such as occurs with lime, cement and similar dusts or it may result from the mechanical action of the dust in closing the pores and the hair follicles of the skin.

The occupational disease law of Ohio provides compensation for disability resulting from dermatitis. If there is no disability, claims then are presented for the payment of the medical expense for the treatment of the disease.

From the standpoint of frequency, dermatitis is the most important of all the occupational diseases now compensable. About 65% of all claims filed for occupational disease come under this classification. Most of the claims are for medical services only, but occasionally claims are filed in which disability results.

The claims filed show that dermatitis originates in a wide variety of industries throughout the state. It seldom happens that more than one or two claims are filed from the same plant in a given month. Occasionally, however, a series of cases of dermatitis will develop from the use of a certain chemical or solution.

Only recently a number of cases of dermatitis were reported among the employees of a soda fountain. It was found that a new cleansing solution had been put into use for washing glassware and that this was responsible for the irritation of the hands.

The prevention of industrial dermatitis is accomplished in two ways. First, by protecting the skin against contact with liquids, dusts or any irritating substances. Second, by cleanliness and care of the skin on the part of those who are required to work where such hazards exist.

Much can be accomplished by keeping the skin clean and by the frequent removal of any material which may lead to skin irritation. Occasionally the application of some protecting ointment or solution is of benefit, not only in avoiding contact of the skin with irritants, but also in keeping the skin soft and pliable.

Employers can do much to prevent dermatitis where hazards exist by providing suitable protective equipment such as rubber boots, aprons and gloves for the use of their employees and by maintaining well equipped washrooms.

* W. E. OBETZ, M.D., Medical Inspector, Division of Safety and Hygiene, State of Ohio, in *O.I.C. Monitor*, March, 1938.

True Cause of Lack of Medical Care

SURVEYS, investigations, studies, statistical reviews, reports and other inquisitions have in recent years been applied to the medical profession with such frequency and regularity that the conscientious medical man is apt to consider such studies as propaganda, issued by someone with an axe to grind and largely of no real benefit to anyone.* A recent report, however, of the United States Public Health Service is interesting because for once the medical profession is not accused of inefficiency, inadequacy and selfishness. For once the lack of medical care for a large section of the population is not laid at the door of the medical practitioner.

Since no individual or group is accused by this report and since it does not show the medical profession to be withholding for selfish reasons proper medical service from the public, this statement of the United States Public Health Service will probably not receive wide publicity. Nevertheless, it does contain certain food for considerable thought. A Works Progress Administration grant of $4,000,000 provided funds for the study. A total of 800,000 families, representing 2,800,000 persons, were quizzed by the W. P. A. investigators. Of these families, 80% had incomes of less than $2,000 a year, and 40% less than $1,000. The report showed that 30% of illness in these low income families received no medical care. It further showed that the infant death rate among the families with the lowest incomes was 168 per 1,000, as compared to 30 per 1,000 in a group of families of $3,000 annual income.

It is, therefore, quite apparent, that the inadequate distribution of medical service, so long and so loudly decried by the reformers and promulgators of studies on medical care, belongs in the same category as the inadequate distribution of good food, decent lodging, proper clothing and other essentials of human existence. For once it is shown that those able to purchase the ordinary necessities of life are also able, under the present system, to obtain sufficient first-class medical service. It is, therefore, apparent, that correction of the evils of inadequate medical service to large groups of the population will be corrected when the general economic situation is corrected. The solution of the problem of medical care for the indigent is no more simple than that of the problems of proper food, proper clothing, proper housing.

Indeed, the report itself states: "It is apparent that inadequate diet, poor housing, the hazards of occupation and the instability of the labor market create immediate health problems." At last the blame falls where it should.

* *Northwest Medicine*, February, 1938.

Workmen's Compensation Practice

DURING the past calendar year, 1,869 physicians of New York State were newly authorized to practice in workmen's compensation cases, according to an announcement made by Industrial Commissioner Elmer F. Andrews.* This brings the total number of such authorized physicians to 15,672 out of the 21,880 physicians licensed to practice medicine in the State. The great bulk of those newly authorized during 1937 was in the Metropolitan District, 1,482. In the Albany District the number was 114;

* *Medical Record*, March, 1938.

in the Syracuse District, 71; in the Rochester District, 61; and in the Buffalo District, 141. The total number now authorized in the respective Districts is as follows: Metropolitan District, 10,576; Albany District, 1,545; Syracuse District, 1,289; Rochester District, 1,114; Buffalo District, 1,248.

The medical practice provisions of the Workmen's Compensation Law provide for arbitration by committees named by County Medical Societies in the case of disputed medical and hospital bills presented for treatment of compensation cases. During last year, 683 such bills representing a total of $62,001.52 were arbitrated. The awards made by the Arbitration Committees totaled $34,110.50, indicating an average reduction of each disputed bill of 45%.

The Dietary Control of Essential Hypertension

A NEW method of treatment which is capable of reducing the high blood pressure of essential hypertension and keeping it under control was recognized quite by accident in 1930.* The method is one of diet alone and is actually a specified diet, eliminating those specific foods which by clinical tests are proved to be capable of maintaining an increased blood pressure, and are capable of reproducing the frequent associated symptoms, such as headache, vertigo and sensations of pressure in the head. The correct diet is determined by means of individual food tests, using the Rinkel and Gay modification of the leukopenic index. Incompatible foods are then eliminated and a period of clinical observation is carried out. After the blood pressure returns to normal, each specific food is re-introduced into the diet and the progress of the patient is carefully watched to determine the effect of each food. If there is a return of hypertension and associated symptoms after any food, then that specific food as such and its use in the preparation of any composite article of diet is completely and totally eliminated. Reproduction of symptoms by the purposeful inclusion of a food in the diet is considered as essential in order to prove that any specific food or foods is an actual offender. This clinical test has been made repeatedly and has furnished abundant proof that the food factor is of prime importance in the continuation of essential hypertension. Twenty-five cases of essential hypertension with ages ranging from 28 to 67 years of age were presented and in this series there was a high percentage of satisfactory results. The period of observation was from four months to eight years, but only two patients have been treated less than one year. Three illustrative case histories were presented in detail, demonstrating how it was possible to cause marked hypertension to be reduced to normal and to be maintained at a normal level after having resisted other types of treatment for 10 or more years. The use of a specified diet in the control of essential hypertension has much merit, it is accompanied by the control of the increased blood pressure, and concomitant symptoms, and the end results justify an optimistic clinical outlook not heretofore possible by other methods of management.

* Abstract of paper presented by L. P. GAY, M.D., at the St. Louis Medical Society, March 1, 1938; published in *Weekly Bulletin of the St. Louis Medical Society*, March 28, 1938.

Medical Supervision

IN the early years of medical practice in this country, the physician's equipment consisted mostly of a stethoscope, a few minor surgical instruments, and a good horse.* His faithful wife was often his helper. As scientific medicine advanced, more and more of the physician's time was taken up with the details of laboratory and other routine work. It was logical, therefore, that in time the lay assistant should take over part of this routine technical work. However, the physician was still responsible for and supervised his assistant.

As so often happens in periods of transition, these various technical groups have tended to become more independent, forgetting that they are only assistants to the doctor of medicine, skilled in some specialized line. As a result, we have seen efforts made to have the various state legislatures legalize the practice of physiotherapy, and to legalize independent lay x-ray laboratories. These are only two examples of the failure to recognize the fact, that the tail can't wag the dog.

* *Medical Bulletin*, Sedgwick County, Kansas, Medical Society, April, 1938.

From the Archives

TWO events have taken place in the field of industrial medicine during the past year which may be cited to show the way industrial medical service is tending.† The first was the Fifteenth Annual Safety Congress at Detroit. The subject of health problems was the dominating issue of this conference, it being the feeling of the group that "health service should be based fundamentally on prevention which, from the industrial standpoint, is far more important than curative medical or surgical procedures." The second was the annual meeting of the Association of New York Central Lines Surgeons at which was presented a symposium on periodic health examinations.

Industry is now assuming and will continue to more widely assume the responsibility for sickness in its workers. As one industrial hygienist has put it, the industrial physician "ought to be projected into the great scheme of production and not forever played as a life saver." There is no logical reason why the financially more important problems incident to sickness should not be made a part of the cost of production as has been the case with accidents; but most important of all is the service that provides for careful examinations before employment, correction of physical defects, early treatment of minor ailments and other procedures calculated to preserve the health and efficiency of the worker, upon whom the quality and quantity of production depend.

Hayhurst has summarized the values to be aimed at as follows:

1. Control of environment, personal hygiene, and physical examinations.
2. The fundamentals of industrial health which require that cost of production include the cost of health maintenance.
3. The application of health standards directly to the working classes.
4. Organization, official and non-official, for effective administration with qualified personnel.

What form will these activities take? There are several possibilities:

1. The extension of private insurance services to include this work in industrial medicine; this is now being practiced on a large scale in some eastern cities.
2. The inclusion of a division or a bureau of industrial hygiene as a part of the State Health Department. This procedure has met with considerable success in some states.
3. Probably best of all is the formation of competent medical groups which will have contact with industry on the one hand and research relations with hospitals and medical schools on the other. Such a group could foster a program of education among industries, demonstrating the value of health service and also cooperate in teaching and research in medical schools and hospitals.

† From an article by C. O. SAPPINGTON, M.D., DR. P.H., published 10 years ago this month.

Care of the Indigent Sick

CHANGES in the administration of medical service are usually urged for the benefit of the indigent; in modern governmental plans these are the last persons considered.* Sickness insurance, "medical cooperatives," group hospitalization and all the prepayment schemes offer nothing to the unemployed or indigent. They have no funds to contribute, no wages from which deductions can be made for the support of organizers, administrators, solicitors or propagandists. The indigent have until recently been left to the care of salaried physicians, most of whom were political appointees. The quality of the services was long a public scandal. Organized medicine, almost alone, demanded decent medical service for the poor. When millions became indigent, abuses were so multiplied that they could no longer be overlooked and some of the professional proposals were adopted. Wherever organized medicine was consulted, the poor

* Current Comment in *J.A.M.A.*, September 25, 1937.

chose their physicians and service was supervised to insure good standards. The gratuitous services of practicing physicians have always been the main source of supply for medical service to the indigent. Physicians seldom complained of this burden. More recently they have welcomed aid from public funds or private philanthropy when this was not accompanied by the kind of lay control which depreciates the value of medical service. Most proposals for new schemes of medical service to the indigent would begin by depreciating the quality of the service. Fortunately, most of these schemes have never materialized. Just about 90% of the plans that have actually gone into operation and have supplied any additional service to the poor have been proposed, directed and operated by organized medicine.

Industrial Deafness

INDUSTRIAL deafness, as such, has within recent years received rather scant attention by the otological world.* Laymen, on the other hand, are aware of some of the ill effects of noise. Office managers know that their employees make fewer mistakes, become less fatigued and do better and faster work under conditions of quiet. Certain cities have passed ordinances regulating the hours during which automobile horns, compressed-air hammers and loud speakers may be used. Factory employees work with their ears stopped with plugs of cotton. Zones of quiet are established about hospitals. It is probably true that some of these anti-noise campaigns are inaugurated or abetted by companies who expect to profit from the sale of sound-proofing materials, but it is evident that there is an active campaign against the terrible din of our city streets. It can be said with certainty that no one knows to what extent these street noises adversely affect hearing, for no studies of this nature have been made.

Eastman X-Ray Developments

A NEW "no-screen" x-ray film, with maximum sensitivity to direct radiation, and a new type x-ray intensifying screen designed to record utmost detail and definition in radiographs are announced from Rochester by the Medical Division of the Eastman Kodak Company.

The new Eastman No-Screen X-ray Film is chaarcterized by its tion, its latitude and its ability to high sensitivity to direct x-radia- record minute detail with brilliant contrast. It is particularly suitable for those technics in which it is considered preferable not to use intensifying screens when sharpest definition and detail are essential and satisfactory immobilization of the patient is possible. Exposure required is considerably less than that needed with Eastman Ultra-Speed X-ray Film, when similarly employed without intensifying screens.

These traits particularly fit the No-Screen Film for radiography of the thinner parts. The safety base of the film is blue-tinted to the correect tone to emphasize detail and contrast. This film is available in all standard sizes.

The new Eastman *High-Definition* X-ray Intensifying Screens are designed to provide maximum definition in radiographs of thicker parts, where direct exposures are not practical. The screens are grainless, free from after glow, and have surfaces that will not abrade or scratch easily. Normally, these screens require twice the exposure needed with the Eastman *Ultra-Speed* Screens, but this difference can be offset readily and to advantage by the use of higher kilovoltage. Prices are materially lower than for the "speed-type" screens.

* C. C. Bunch, Ph.D., in *The Laryngoscope*, quoted in *Digest of Treatment*, February, 1938.

Anti-Influenza Tablets

IN RECENT years there has been a serious loss of working time and output at collieries in the Midlands coalfields because of outbreaks of influenza among the workers.* As an experiment the management of Houghton Main Colliery, South Yorkshire, has presented to each worker a three-weeks' course of anti-influenza tablets made to order from a specialist's prescription. The experiment will be watched with interest, for in recent years the workers have lost a considerable sum in wages and colliery staffs have been reduced.

* *Labour Management*, March, 1938, quoting *The Times*.

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